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The Fifty-Third Meeting of the American Astronomical Society

By DEAN B. McLAUGHLIN

The fifty-third meeting of the American Astronomical Society was held December 27 to 29, 1934, at Philadelphia, on invitation of the Franklin Institute. The University of Pennsylvania, Haverford College, and the Rittenhouse Astronomical Society joined in entertaining the visiting astronomers. Headquarters for the meeting were at the Hotel Sylvania, where most of the astronomers had rooms as close to the stars as possible.

Shortly before leaving Ann Arbor the writer received a telegram from the secretary, stating that he would be unable to attend owing to illness, and asking the assistant secretary please to pinch hit for him. Having just recovered from a similar illness, the assistant secretary was unable to think of a valid excuse, and so did not let this request deter him from attending. The secretary was missed by all, particularly by the writer.

On the way from Ann Arbor to Philadelphia, via Canada, the near-zero temperature did not augur well for weather conditions during the meeting, but the cold weather passed far to the north, and Philadelphia had none of it.

The first session began at ten o'clock Thursday morning. Theoretically the Ann Arbor delegation, consisting of Curtis and the writer, had arrived at Reading Terminal two hours earlier. Actually they were at that moment seated in a Pullman car on a siding at Bethlehem. Their telegram to Stokley: "Valuable Ann Arbor contingent delayed by blizzard arriving noon," caused the Society some worry on account of the ambiguity of wording.

At the beginning of the session the astronomers were welcomed by President McClenahan of the Franklin Institute, and President Russell responded for the Society. Several papers were presented, after which the photograph was taken in the planetarium dome. That this was something of an ordeal may be inferred from the expressions.

The Ann Arbor contingent arrived in time to meet the rear guard of the Society retreating from the skirmish with the photographers, and in time to have lunch with a considerable number of members at Holland's Restaurant. They experienced considerable difficulty in convincing anyone that they had been in a blizzard, for Philadelphia obviously was not repeating the frigid reception accorded by Boston a year ago.

After lunch the members migrated to Houston Hall at the University

of Pensylvania, where the afternoon session for papers was held. Following this they were guests of the University at tea. When tea was over the sky was dark enough to permit observations of Nova Herculis. The first two or three to go out succeeded in making their observations in comparative tranquillity, but soon traffic was partially blocked by the crowd who spent half the time looking at the nova and the other half arguing about the magnitudes of the comparison stars. In the end nobody was convinced, and each went on using the magnitudes of his own choice. However, all were able to agree that the nova had recovered from a spell of faintness on the previous night.

That evening the Society assembled again at the Franklin Institute, in joint session with the Rittenhouse Astronomical Society, to hear Dr. W. S. Adams' retiring presidential address on "Some factors in the design of a large telescope." This included particularly a description of many novel features to be incorporated in the 200-inch reflector for California Institute of Technology. Movie thrillers of the future will probably include as one episode the imprisonment of the hero or heroine in the observing cell at the principal focus of the great reflector. The address was followed by a reception for the visiting astronomers by the Rittenhouse Astronomical Society. This concluded a very full day's program.

On Friday morning buses called at the Hotel Sylvania to take the Society to Haverford College, the early "stamping-ground" of ex-president E. W. Brown. President Comfort of Haverford College welcomed the Society and spoke briefly of a century of astronomy at Haverford. The major portion of the morning session was devoted to a discussion of stellar parallax, with special reference to the future needs of astronomy in this field. The subject of systematic differences was intentionally left out.

Following this session the members were guests of the College at luncheon. At this time the meeting of the U. S. National Committee of the International Astronomical Union, which the secretary had optimistically said "will be worked in somewhere," was held. What time remained after luncheon and before the afternoon meeting was devoted to inspection of the new Strawbridge Memorial Observatory. Many interesting papers were presented at the afternoon session which terminated about five o'clock, when the members embarked on the buses and returned to Philadelphia. All except the acting secretary were then able to rest for an hour or so before dinner.

The members and guests assembled in the dining room of the hotel at seven-thirty, and there followed a few hectic minutes while the President and acting secretary rounded up those who were to sit at the speakers' table. At the conclusion of the dinner President Russell made the first award of the Annie J. Cannon prize and pin to Mrs. Cecilia Payne Gaposchkin, in recognition of her valuable work in interpreting stellar spectra. After speaking briefly in acceptance, Mrs. Gaposchkin then called upon Miss Cannon who told a few anecdotes concerning the

preparation of the Henry Draper Catalogue. The distance we have come within the period of one man's active work in astronomy is illustrated by Dr. Adams' anecdote of an astronomer of the old school who admitted having looked at the "soda lines" but "didn't think much of 'em."

On Saturday morning a special demonstration of the Planetarium was given for the Society. President McClenahan called upon Mr. Fels, donor of the Planetarium, who spoke briefly in presentation of a comet projector which was so new that the mechanicians had not yet got it in final adjustment. Its performance showed that it will be very effective when it is adjusted. The filmy appearance of the comet's tail projected on the dome with the stars gave the perfect illusion of transparency. Mr. Stokley then put the Planetarium through many of its paces, showing latitude and precession effects, the regression of the moon's nodes, and other phenomena. The sky between Vega and the head of Draco, however, did not appear true to life, as Carl Zeiss does not maintain a service for installing novae "while you wait."

A session for papers followed, and as the program progressed it appeared possible to finish without an afternoon session. As an entering wedge, continuation until one o'clock was suggested and was not unfavorably received, whereupon about half of those present left immediately. As one o'clock approached it was seen that another half hour would complete the program. A vote was taken; half of those present favored completing the program without intermission and the other half did not vote. When the last paper had been delivered and discussed a resolution of appreciation, addressed to the numerous hosts of the Society in and about Philadelphia, was presented by Cleminshaw and Miss Dodson.

Immediately after the close of the meeting of the Society, the American Section of the International Astronomical Union held a short session.

Those who had left early returned at two-thirty and found no meeting to attend. A number of them, finding the afternoon unexpectedly free, were able to look over some of the exhibits of the Museum, including the Rittenhouse orrery which may be called the "great granddaddy" of the Planetarium.

No attempt will be made to summarize the papers presented. The total number considerably exceeded the average for a meeting, forty-three being presented and two read by title, exclusive of the symposium on parallax. The program was unusually astrophysical. Four papers dealt with the spectrum of Nova Herculis, and each author vied with the others in presenting the latest word, received by special delivery and by telegraph. The Michigan representative had an unfair advantage in being "in cahoots" with Dr. Mohler at Mr. Cook's observatory. Two papers gave light-curves and dimensions of the eclipsing system Zeta Aurigae. Results of study of ultra-violet stellar spectra secured by the Cornell expedition were presented in two papers. The show was stolen by R Aquarii which appears to be a Dr. Jekyll and Mr. Hyde, as

well as several other people. The President, instead of asking for discussion of this paper, inquired: "Is anyone bold enough to suggest an explanation?" The record for presentation of papers, established by Dr. Plaskett at Boston, was tied by Dr. Adams who presented five papers by members of the Mount Wilson staff.

Two meetings were held by the Council and seventeen new members were elected to the Society. A total attendance of 102 members was recorded. Thanks to the careful planning by Mr. Stokley and the many other hosts, everything ran smoothly, and the meeting stands out as one of the best in the history of the Society. The older members were more numerous than at several meetings within the writer's memory, and they should be given every encouragement to come often and in great numbers.

The last scene is laid in Professor Dugan's study at Princeton. McLaughlin has just arrived.

DUGAN: Well, let's hear what happened at the meeting.

MCLAUGHLIN: That's a rather large order. Can't you wait until the account comes out in POPULAR ASTRONOMY?

DUGAN: I could if I were sure I could tell from your story what really happened.

CURTAIN.

Professor Dr. W. de Sitter

By A. van MAANEN

The news of de Sitter's death on November 20, 1934, was a severe shock to the astronomical world and to his numerous friends; we had not even known that he was sick. Only later reports told how an attack of influenza brought on pneumonia and this within a few days proved to be too much for him, whose physical condition was never very strong. The University of Leiden loses in him a scientist of the first rank and the observatory a director who brought it back to an institution of excellent standing.

De Sitter was born in Sneek in 1872. He went to the University of Groningen with the intention of studying principally mathematics, but the contact with Kapteyn, who was then working at the Cape Photographic Durchmusterung, in conjunction with Gill, turned his mind to astronomy. When Gill visited Kapteyn in Groningen in 1896, he invited de Sitter to come to the Cape for the reduction and discussion of the heliometer observations of the satellites of Jupiter, which had been made by Gill and Finlay in 1891. De Sitter went to the Cape in 1897 and stayed there more than two years. While he did some photometric work in connection with the Cape Photographic Durchmusterung and also some parallax and triangulation work with the heliometer, his main interest lay in the discussion of the Jupiter observations.

While these results were published in de Sitter's thesis for his doctor's

degree in 1902, the subject continued to hold his attention and the thoroughness of his work is evident to the readers of the annals of the Leiden Observatory, vol. XII (1918-1925) and XVI (1928-1929), all of which deal with discussions of the satellites of Jupiter, either by de Sitter or by his collaborators. In condensed form a summary of these results appeared in *Bulletin of the Astronomical Institutes of the Netherlands,* III, 247, 1927.

A second kind of work of considerable value dates from the time that de Sitter was assistant to Professor Kapteyn in Groningen 1900-1908. During that time his contributions to statistical astronomy were made, dealing with the difference in color in galactic and non-galactic stars, his determination of the proper motions and parallaxes of the Hyades (in collaboration with Kapteyn) and of the proper motions and parallaxes of some 3500 stars in different galactic latitudes.

In 1908 de Sitter was called to Leiden as professor of theoretical astronomy and in 1919 his appointment followed as Director of the Leiden Observatory; this gave him the chance for showing his great ability as an organizer. The Leiden observatory, up to that time an institution devoted entirely to astronomy of position, by the efforts of de Sitter became a very modern observatory through the addition of a department of astrophysics and one of stellar statistics. He further developed an arrangement with the Observatory at Johannesburg in South Africa, first to enable the Leiden observers to work in the Southern hemisphere; but in the later years he was able to secure the funds for his own instruments in a climate where the observing conditions are far superior to those at Leiden.

In 1921 he was largely responsible for the establishment of a new astronomical publication, the *Bulletin of the Astronomical Institutes of the Netherlands,* which outside of about 30 articles by himself shows the enormous activity of the Leiden observatory since its reorganization.

So far I have not mentioned one of his greatest contributions to astronomy, his investigations in the theory of relativity. In 1915 Einstein had published his general theory of relativity; de Sitter published during the next two years a series of three masterly papers in the *Monthly Notices,* which brought the theory to the attention of the English-speaking astronomers. The three astronomical tests, the shift of the perihelia of the nearer planets, the bending of the light by the sun, and the spectral-shift towards the red were developed and were subsequently tested with considerable success by different astronomers all over the world.

In his third paper de Sitter enlarges the possibilities of the theory of relativity by differentiating between a universe in which the world matter is distributed through the whole of the finite universe (the Einstein-Universe) and a universe without matter (the de Sitter universe). It is typical of the modesty of de Sitter, that he refers to these two theoretical possibilities as systems A and B. An important point in the system B is, that the frequency of the light vibrations diminish with in-

creasing distance from the origin of coördinates. The lines in the spectra of very distant stars or nebulae must therefore be systematically displaced towards the red. This prediction has in recent years found considerable confirmation in the red shifts of the fainter nebulae, and while the theory of de Sitter is now generally accepted only in a modified way, he certainly is responsible to a large degree for our recent ideas of the universe.

There are several other lines of work such as the flattening and constitution of the earth, the uniformity of the earth's rotation, a discussion of the astronomical constants, etc., that might be mentioned in an obituary of de Sitter, but I have meant to call particular attention to his three main lines of work.

That his work was felt to be of high standard is evident from the awards of the three most important medals awarded to astronomers, the gold medal of the Royal Astronomical Society, the Bruce medal of the Astronomical Society of the Pacific, and the Watson medal of the National Academy of Sciences at Washington. From 1925 to 1928 de Sitter was president of the International Astronomical Union and the 1928 meeting was held in Leiden, where he had the great satisfaction of seeing for the first time at these meetings astronomers from 27 countries, both from the allies and from the opponents.

Another event, which must have given de Sitter great satisfaction in recent years was the celebration of the 300-year existence of the Leiden Observatory. If we see to what standing he was able to bring this observatory since the reorganization in 1919, if we look at the list of his collaborators and at the enormous number of valuable papers that have come from Leiden during the last 15 years, we cannot but admire his power of organization. While he reached the age of 62 only, it fills us with the greatest respect to see what de Sitter did accomplish during his life.

His many friends, in Holland and also in England, America, and South Africa, will keep him in grateful memory as a first-class astronomer as well as a very fine man.

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Astronomy without a Telescope

By HAROLD D. BABCOCK

Evidence of widespread interest in astronomy is found in the large number of amateurs who have built their own telescopes and applied them to the observation of the heavens. Much has been written to encourage the design and construction of such instruments and to extend their application to the study of the nature of the heavenly bodies, all of which is immensely valuable. But another kind of observation underlies many of the important applications of astronomy to the affairs of everyday life, and this has to do, not with the nature of the stars, but with their apparent positions in the sky. Business and pleasure alike depend upon accurate time derived continually from the stars. Travel at sea and exploration of desolate polar wastes are guided by celestial beacons that give the latitude and longitude reliably. The boundaries of farms and of nations are fixed with reference to lights in the sky!

Probably two reasons account for the fact that so little attention has been given to the introduction of amateurs to this kind of astronomical work. Few homemade telescopes are equipped with accessories for measuring angles; and the effective use of angular measurements requires in this case a knowledge of spherical trigonometry, a branch of mathematics whose beauty and power are familiar to few except scientists, mariners, and engineers.

In spite of these facts, however, illustrations of how the astronomer, the navigator, and the surveyor get some of their valuable results from observations of the sun can be made very easily. A satisfactory explanation of the method can hardly be given without the use of higher mathematics, but anyone who understands the idea of arithmetical proportion and is familiar with the designation of angles in degrees, minutes, and seconds of arc can find the latitude and longitude of a land station in the temperate zone, and afterwards can determine the time at that station. This can be done by rule, without telescope or astronomical equipment other than that which the observer can make for himself in an hour or two at very little cost. If directions given here are carefully followed the results are likely to prove surprisingly close to the truth, as will be shown by examples farther on.

The methods chosen for illustration are among those in common use by both navigators and surveyors, but, because of limitations in the instrument to be described, the reader will be restricted to work on land unless he has a sextant. Although the directions are written particularly for readers in the continental United States they can readily be extended greatly, but must not be expected to apply at high latitudes in winter.

The only astronomical observation we shall have to make is that of finding the angular height of the center of the sun above the horizon.

This is called the sun's altitude. For determining the latitude we shall find the altitude near noon, when it is greatest for the day. To get the longitude we shall observe the solar altitude at a known time several hours before or after noon. An instrument for measuring altitudes is called an altimeter. Various simple devices can be adapted to serve as altimeters, but only one is described here. Some readers may prefer to follow their own designs rather than the directions given below.

The altimeter is to be made of wooden pieces preferably fastened together with screws. If the joints are mortised the structure will be rigid and most likely to retain its value for a considerable time. The first piece of wood to prepare is a 2x4 about 30 inches long. This should be surfaced on all four sides and should have one of its wider sides particularly well planed and marked for the top. Near one end of the top is fastened a vertical board 3 to 5 inches wide and about two feet long. It should have one or two substantial braces to keep it in place and before assembly it should have several holes made in a row along its center line. These should be located roughly 8, 12, and 16 inches, respectively, above the top side of the 2x4. The size of the holes should be about ¼x1 inch, with the long side horizontal. Over each hole a pair of safety razor blades should be attached with small wood screws so as to form a narrow horizontal slit whose width may be adjusted a little because the screws are smaller in diameter than the holes in the blades. It will be necessary to bevel one side of each hole in the upright board so that light passing through the slit may reach the base of the instrument.

For giving stability to the apparatus a simple cross bar should be attached to one end of the 2x4, and through its ends and the opposite end of the base screws should be passed to aid in levelling. It is convenient to have the lower ends of these screws rounded and smooth.

At the upper surface of the base a narrow slot is cut in the upright board so that a steel tape may lie on the 2x4 and pass through the upright. The upright should be fastened as nearly perpendicular to the base as possible. Provide a small block of wood having a white card attached to one edge with tacks. The little block sits on the smooth surface of the 2x4 at any desired distance from the upright and holds the white card in a vertical plane parallel to the slits. A fine black line is drawn horizontally across the face of the card and the distance from this line to the upper side of the 2x4 is carefully measured and marked on the margin of the card.

The only accessories required are a steel tape or other accurate scale of sufficient length and some means of levelling the altimeter. The best tape is one divided into millimeters. A good machinist's spirit level is especially satisfactory because of its sensitivity and compactness, but even a small inexpensive spirit level will suffice for illustration of the method, or a plumb bob may be hung from the top of the altimeter and used with a square.

The use of this altimeter is extremely simple. It is set up on the

ground or on a firm support in such a position that sunlight shines through at least one of the horizontal slits in the vertical board and falls as a narrow streak on the top of the base. The instrument is then levelled and the horizontal distance of the center of the streak of light from the vertical plane containing the slit is measured. The vertical height of the slit above the base is also measured and from the two distances the sun's altitude can be found by a method described farther on.

For the observer who wishes merely to illustrate the methods of finding latitude and longitude with the altimeter no refinements of procedure are necessary. But one who aims to get the greatest accuracy that this simple instrument can give may find help in a few hints about its use. Because the streak of light from the slit has considerable width and also has edges that fade out gradually, it is well to let it fall on a uniform, smooth paper surface on which a fine black line has been drawn parallel to the streak. A little practice enables one to set the line on the middle of the streak with greater accuracy than might be expected. Still greater precision is had by the following method of observation, which is particularly commendable when the altitude is changing rapidly. Place the paper so that the streak of light approaches the black mark as the sun moves across the sky. Note the time when the edge of the streak first definitely touches the line. Note the time when the line appears to bisect the streak, and finally the time when the streak leaves the line. The average of the first and last times should be the same as the time of bisection. From ten successive trials the writer found no difference greater than 5 seconds, while the average difference was only 2 seconds. The average of the middle time with the mean of the first and last is the most reliable value of the time corresponding to the position of the black line that was used as a reference mark.

For observing the sun high in the sky it is best to allow the streak of light to fall directly on the top of the base of the altimeter. When the solar altitude is less than 45° however, it is more satisfactory to receive the streak of light on a vertical card carried by a small block of wood on top of the base as already suggested. In this case the black reference line will be a short distance above the base and this distance must of course be subtracted from the vertical height of the slit above the base.

There are two reasons for providing more than one slit. First, the altimeter is adapted to a greater range of altitudes than with a single slit; and second, a useful check on the accuracy of measurement is obtained by having more than one set of numbers to use in computation. A few minutes of experience with this simple instrument will make its use more clear than an extended written description, but the following account of a determination of latitude with it may be helpful.

On a clear morning about half an hour before noon the altimeter was set up on the ground with the slits facing the sun, and the base was so placed that the streaks of light from them fell on its upper surface. It was then carefully levelled and light pencil marks were made at the

edges of one streak of light. From the motion of the strips of light on the base it was soon evident that the sun in its apparent westward journey across the sky was still climbing higher above the horizon. From time to time it was necessary to turn the altimeter so as to keep it facing the sun. Each time it was relevelled as carefully as before. After fifteen or twenty minutes it was noted that the sun was getting no higher in the sky—only moving westward. The positions of the edges of each little streak of light on the base were then carefully marked with a fine pointed pencil and their distances were measured from the front side of the vertical board that carried the slits. The vertical distances of the two slits above the base were also measured. Here are the results:

	——Horizontal distances—— observed		average	Vertical distance
	mm	mm	mm	mm
Lower slit	172.0	175.0	173.5	202.2
Upper slit	238.5	242.5	240.5	280.5

How shall we find the sun's altitude from these numbers?

In the right angled plane triangle of Fig. 1 the vertical line represents the center line of the upright part of the altimeter that carries the slits and that is directed, when the base is level, to the point straight

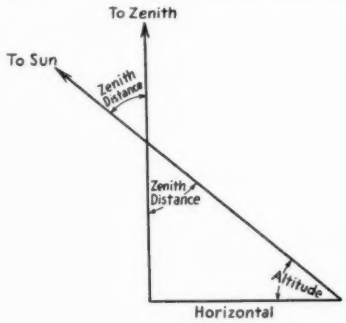

FIGURE 1.

overhead called the zenith. The angle between this line and the line pointing to the sun is called the zenith distance of the sun. Since in any plane triangle the sum of all the angles is equal to two right angles it is evident from Fig. 1 that zenith distance is just ninety degrees minus the altitude. Evidently then our instrument is not only an altimeter but is also a zenith-distance measurer, since either angle can be found from the other by mere subtraction from 90°. It is in fact the zenith distance rather than the altitude that we shall finally use in the determination of latitude and longitude.

The first use we shall make of our measurements is to divide the smaller by the greater. Thus the first average horizontal distance is 173.5 mm and the corresponding vertical distance is 202.2 mm. Divid-

ing we find the quotient 0.8578. For the other slit, $240.5 \div 280.5 = 0.8572$.

We turn to Table I for aid in finding the angles that are defined by the quotients just derived. In this table a series of angles in column one

TABLE I

Angle	Quotient	Difference	Angle	Quotient	Difference
15°	0.2679		30°	0.5774	
		188			235
16	0.2867		31	0.6009	
		190			240
17	0.3057		32	0.6249	
		192			245
18	0.3249		33	0.6494	
		194			251
19	0.3443		34	0.6745	
		197			257
20	0.3640		35	0.7002	
		199			263
21	0.3839		36	0.7265	
		201			271
22	0.4040		37	0.7536	
		205			277
23	0.4245		38	0.7813	
		207			285
24	0.4452		39	0.8098	
		211			293
25	0.4663		40	0.8391	
		214			302
26	0.4877		41	0.8693	
		218			311
27	0.5095		42	0.9004	
		222			321
28	0.5317		43	0.9325	
		226			332
29	0.5543		44	0.9657	
		231			343
30	0.5774		45	1.000	

are set opposite a series of quotients in column two. A glance shows that both our quotients fall between the numbers in the second column that correspond to the angles 40° and 41°. For rough work we might let it go at that and say that the angle is about 40° 30′. Here we must note a rule. If the horizontal distance is less than the vertical the quotient of the smaller by the greater will give us the zenith distance. If the reverse is true this quotient gives the altitude, which must be subtracted from 90° to get the zenith distance.

Let us see if we can find these angles a little more accurately from our quotients. For this purpose the third column has been added to Table I. Here the numbers are printed not on the same horizontal lines as the other numbers, but in between, and this is to indicate that they correspond to the differences between adjacent numbers in the second column. For example between horizontal lines for 40° and 41° we find in the third column the entry 302 and inspection shows that this is the difference, in units of the fourth decimal place, between the values 0.8391 and 0.8693. Now the first of our quotients is 0.8578. We take

the difference $0.8578 - 0.8391 = 0.0187$, move the decimal point 4 places to the right and find 187. Divide 187 by 302 and find 0.619. This means that the quotient 0.8578 corresponds to an angle 0.619 of the way between 40° and 41° or simply to the angle 40°.619. This looks a little strange perhaps, because we may not be accustomed to seeing angles expressed in degrees and decimals. We have merely to note that 0°.619 is equivalent to $0.619 \times 60'$ or 37′ and then rewrite our angle 40° 37′. In the same way we see that the other quotient, 0.8572, corresponds to the angle 40° 36′ and we take the average of these two observations, 40° 36′.5, as the value of the sun's zenith distance at noon for the place and date of observation.

In order to find the latitude from the solar zenith distance just measured an angle called the sun's declination must be known. A clear definition of the term, declination, would require the introduction here of several other terms that are used by astronomers in discussing the positions of the heavenly bodies. We shall omit these technical terms and merely state the rules that are used in our problems. The interested student will find in many text-books more complete treatment of the methods of determining latitude and longitude.

The sun's declination is an angle that changes continually, passing through a cycle of values once a year, in which it ranges between +23° 27′ and —23° 27′. To facilitate its use tables are prepared giving the value of the angle for each day for several years in advance. Our Table II is a shortened form of one of these more accurate tables, and gives the declination for 3:00 o'clock P.M., Central Standard Time, every fourth day only. The third column contains the average amount by which the declination changes in one hour between the successive dates in the first column. Two examples will illustrate the use of Table II more clearly than much other explanation. An observer using Eastern Standard Time desires to find the sun's declination at noon on March 20, 1935, from Table II. The nearest date in the table is C.S.T. 3:00 P.M., March 18, which is 44 hours preceding. The variation per hour is 0′.99 as shown in column 3. The product $44 \times 0'.99 = 43'.6$. This added to —1° 3′.5 from the table for March 18 gives the result —0° 29′.9. Another observer using Pacific Standard Time requires the sun's declination at 4:00 P.M., August 31, 1935, which is 45 hours before 3:00 P.M., September 2, C.S.T. Multiply, $45 \times 0'.90 = 40'.5$. Add to +8° 01′.8 and get +8° 42′.3 for the required declination.

In carrying out the process illustrated in these examples, which is known as interpolation, mistakes of sign are sometimes apt to occur. To avoid these it is necessary to note in which direction the declination is changing. In case of doubt plot on cross-section paper two points representing data from Table II that include the date for which the declination is desired. Connect these points by a straight line and read off an approximate value of the declination corresponding to the intermediate time.

Following the same procedure as that illustrated in these examples,

TABLE II

1935. 3:00 P.M. Central Standard Time.

	Declination	Var. per hr.	E	Var. per hr.		Declination	Var. per hr.	E	Var. per hr.
Jan.	° ′	′	m s	s	Apr.	° ′	′	m s	s
1	−23 1.8		− 3 32		23	+12 26.3		+ 1 38	
		+0.24		−1.16			+0.82		+0.45
5	22 38.6		− 5 23		27	13 44.7		+ 2 21	
		0.31		1.08			0.78		0.35
9	22 8.6		− 7 07		May				
		0.39		0.99	1	14 59.4		+ 2 55	
13	21 31.5		− 8 42				0.74		0.27
		0.46		0.90	5	16 10.4		+ 3 21	
17	20 47.8		−10 8				0.70		0.18
		0.52		0.76	9	17 17.0		+ 3 38	
21	19 57.7		−11 21				0.65		+0.08
		0.58		0.65	13	18 18.9		+ 3 46	
25	19 1.6		−12 23				0.59		−0.01
		0.64		0.51	17	19 15.9		+ 3 45	
29	18 0.3		−13 12				0.54		0.10
		0.70		0.38	21	20 7.7		+ 3 35	
Feb.							0.48		0.20
2	16 53.4		−13 48		25	20 54.1		+ 3 16	
		0.75		0.25			0.42		0.27
6	15 41.6		−14 12		29	21 34.6		+ 2 50	
		0.79		−0.10			0.36		0.36
10	14 26.1		−14 22		June				
		0.83		+0.02	2	22 9.2		+ 2 15	
14	13 6.5		−14 20				0.30		0.42
		0.87		0.16	6	22 37.6		+ 1 35	
18	11 43.5		−14 05				0.23		0.47
		0.90		0.26	10	22 59.7		+ 0 50	
22	10 17.6		−13 40				0.16		0.50
		0.92		0.38	14	23 15.3		+ 0 02	
26	8 49.1		−13 04				0.09		0.54
		0.94		0.46	18	23 24.4		− 0 50	
Mar.							+0.02		0.56
2	7 18.4		−12 20		22	23 26.8		− 1 42	
		0.96		0.54			−0.04		0.53
6	5 46.1		−11 28		26	23 22.7		− 2 33	
		0.97		0.60			0.11		0.52
10	4 12.6		−10 30		30	23 12.0		− 3 23	
		0.98		0.68	July		0.18		0.48
14	2 38.3		− 9 25		4	22 54.7		− 4 09	
		0.99		0.71			0.25		0.43
18	− 1 3.5		− 8 17		8	22 31.1		− 4 50	
		0.99		0.75			0.32		0.34
22	+ 0 31.3		− 7 05		12	22 1.3		− 5 23	
		0.98		0.80			0.37		0.29
26	2 5.8		− 5 52		16	21 25.4		− 5 51	
		0.98		0.76			0.43		0.20
30	3 39.5		− 4 39		20	20 43.7		− 6 10	
		0.97		0.75			0.49		0.10
Apr.					24	19 56.4		− 6 20	
3	5 12.3		− 3 27				0.55		−0.01
		0.95		0.73	28	19 3.8		− 6 21	
7	6 43.5		− 2 17				0.60		+0.08
		0.93		0.69	Aug.				
11	8 12.8		− 1 11		1	18 6.1		− 6 13	
		0.91		0.65			0.65		0.19
15	9 40.0		− 0 09		5	17 3.7		− 5 55	
		0.88		0.59			0.69		0.29
19	11 4.6		+ 0 48		9	15 57.0		− 5 27	
		0.85		0.52			0.74		0.40

TABLE II—Continued

	Declination	Var. per hr.	E	Var. per hr.		Declination	Var. per hr.	E	Var. per hr.
Aug.	° ′	′	m s	s	Oct.	° ′	′	m s	s
13	+14 46.1		— 4 49		24	—11 39.5		+15 42	
		—0.78		+0.48			—0.86		+0.26
17	13 31.5		— 4 03		28	13 1.8		+16 07	
		0.81		0.55	Nov.		0.82		0.14
21	12 13.4		— 3 10		1	14 20.8		+16 20	
		0.85		0.66			0.78		+0.01
25	10 52.2		— 2 07		5	15 36.0		+16 21	
		0.88		0.71			0.74		—0.14
29	9 28.2		— 0 59		9	16 47.2		+16 08	
Sept.		0.90		0.76			0.69		0.27
2	8 1.8		+ 0 14		13	17 53.8		+15 42	
		0.92		0.82			0.64		0.41
6	6 33.4		+ 1 33		17	18 55.4		+15 03	
		0.94		0.85			0.59		0.56
10	5 3.2		+ 2 55		21	19 51.7		+14 09	
		0.95		0.88			0.53		0.69
14	3 31.7		+ 4 19		25	20 42.1		+13 03	
		0.96		0.89			0.46		0.81
18	1 59.2		+ 5 45		29	21 26.4		+11 45	
		0.97		0.88	Dec.		0.39		0.94
22	+ 0 26.0		+ 7 09		3	22 4.2		+10 15	
		0.98		0.87			0.32		1.02
26	— 1 7.6		+ 8 32		7	22 35.1		+ 8 37	
		0.98		0.83			0.25		1.11
30	2 41.2		+ 9 52		11	22 59.0		+ 6 50	
Oct.		0.97		0.79			0.17		1.18
4	4 14.2		+11 08		15	23 15.7		+ 4 57	
		0.96		0.74			0.10		1.22
8	5 46.5		+12 19		19	23 24.9		+ 3 00	
		0.95		0.67			—0.02		1.25
12	7 17.5		+13 23		23	23 26.5		+ 1 00	
		0.93		0.58			+0.06		1.25
16	8 46.9		+14 19		27	23 20.7		— 1 00	
		0.91		0.49			0.14		1.22
20	10 14.4		+15 06		31	23 7.4		— 2 57	
		0.89		0.38					

find the sun's declination at the time when you observed its altitude or zenith distance. The only remaining step in finding your latitude is to combine the zenith distance and the declination. Here it is necessary to note a rule which applies in the northern hemisphere but must be reversed in the southern: When the table gives a negative value for the sun's declination subtract the declination from the zenith distance of the sun; when the declination is positive add it to the zenith distance. The result is the latitude. Thus the zenith distance was found to be 40° 36′.5 and the solar declination at the time of the observation was —6° 28′ as given by the table. The latitude was 34° 08′.5.

Only one further note will be added regarding such observations. Because we live at the bottom of an ocean of air we observe the positions of celestial objects to be slightly higher than they would be if the air were not about us. This effect varies with the altitude. The apparent displacement is small for objects seen high above the horizon but much greater for those at low altitudes. Table III gives in abbreviated form

the corrections to be applied to observations of altitude because of this atmospheric refraction. These corrections are to be subtracted from observed altitudes or added to the zenith distances.

TABLE III

Apparent altitude in degrees	Atmospheric Refraction
10°	5′
13	4
17	3
20	2.5
24	2
30	1.5
40 to 55	1
greater than 55	less than 1′

Returning to the example and taking account of the correction for refraction we have

Observed zenith distance	40° 36′.5
Refraction	1.0
True zenith distance	40 37.5
Solar declination	— 6 28
Latitude	34 09.5

The latitude of the same station is found from a large scale topographic map issued by the U. S. Coast and Geodetic Survey to be 34° 09′ 30″. The close agreement is accidental, as shown by the fact that the two separate observations differed by 1′.0.

Let us summarize all that has been written above about the determination of latitude. Determine the zenith distance of the sun when it reaches its least value for the day. Apply the correction for refraction. Find the sun's declination from Table II. Combine the declination with the corrected zenith distance according to the rule on page 88.

To find the longitude of a station whose latitude is already known we again measure the sun's altitude with the altimeter, but now it is best to work before 10:30 A.M. or after 2:30 P.M. Since it is inconvenient to observe altitudes lower than about 15° with our simple instrument and since the correction for refraction becomes larger and more uncertain at such low altitudes, it is well not to work too near sunrise or sunset. For these measurements it is essential to have accurate time, most conveniently supplied by a watch having a second hand, whose correction and rate have recently been found. The various steps in the procedure are set down in order and those that require it will be discussed below.

1. Observe the solar altitude, recording correct standard time.
2. Correct the observed altitude for refraction by Table III and subtract the corrected altitude from 90° in order to get the zenith distance.
3. Find the sun's declination at time of observation from Table II.
4. Find the sum and the difference of the latitude and the solar declination, noting that for a station in the northern hemisphere there is no uncertainty about doing so when the declination is positive. For a declination having the negative sign we shall call the difference, (designated $L - d$) that one of the two combinations of L and d which is numerically the greater and *vice versa*. Thus $L - d = 46°$ for $L = +34°$ and $d = -12°$, while $L + d = 22°$.

5. Refer to the chart, Figure 2.
   A. Lay a ruler from the value of $L - d$ on the left hand side of the chart to the value of $L + d$ on the right hand scale.
   B. Find on the left hand scale the point corresponding to the zenith distance that you have determined.
   C. Follow a horizontal line through this point until it reaches the edge of the ruler.
   D. Follow a vertical line from the point reached in (C) down to the bottom of the chart and read the time scale there. This quantity is called the sun's Hour Angle. Note it carefully.
6. Refer to Table II and find from column 5, headed E, the number of minutes and seconds corresponding to the time of your observation. Note that E may be either positive or negative. It will be necessary to use the same method for finding E at times between those tabulated that you have already learned to use for getting declinations. Thus the column of differences in E gives the change of E in seconds for 1 hour difference in time of observation. Multiply this by the number of hours between the time of your observation and the nearest date in the table. Apply the product to the tabulated value of E with due regard to sign.
7. Combine your value of E with the time of your observation, following this rule: When E has the sign + it is to be added to the time of observation and when it has the sign — it is to be subtracted.
8. Take the difference between the Hour Angle found in 5 and the result found in 7. The result is the difference in longitude between your station and the standard meridian for which your watch is set. If the Hour Angle is numerically greater than the result found in 7 your station is east of the standard meridian, provided you have made your observations in the afternoon. For morning observations the reverse is true.

Although these directions may seem involved they really are easy to follow. An illustration based on actual experience with the simple altimeter described above is now presented.

Latitude	+34° 09′ 30″
Watch error	51 seconds fast
Observed time of first contact of streak of light on mark	3^h 09^m 15^s P.M.
Observed time of second contact of streak of light on mark	3 12 00
Average	3 10 38
Observed watch time of bisection of streak by mark	3 10 40
Average	3 10 39
Correction	51
Pacific Standard Time of observation	3^h 09^m 48^s
	mm
Horizontal distance from plane of slit to vertical card receiving the light	314.2
Vertical height of slit above base	202.2
Correction for height of mark above base	20.2
True vertical height	182.2
Quotient 182.2/314.2	0.5799
1) Altitude of sun	30° 06′.4
Correction for refraction	1.5
True altitude	30° 04′.9
2) Zenith distance	59° 55′.1
3) Solar declination	—6° 48′

4) $L - d = 34° 09'.5 + 6° 48' = 40° 57'.5$
$L + d = 34° 09'.5 - 6° 48' = 27° 21'.5$

5) Hour Angle = $3^h\ 5^m\ 36^s$ from chart.
6) E from Table II = $-12^m\ 04^s$.
7) $3^h\ 09^m\ 48^s - 0^h\ 12^m\ 04^s = 2^h\ 57^m\ 44^s$.
8) $3^h\ 5^m\ 36^s - 2^h\ 57^m\ 44^s = 7^m\ 52^s$.
Thus the station is $7^m\ 52^s$ east of the meridian for which Pacific Standard Time is correct. Since this meridian is 120° or 8 hours west of Greenwich our longitude is $7^h\ 52^m\ 08^s$ west of Greenwich.

From a copy of the full sized original chart, from which Figure 2 was prepared by reduction, the hour angle was found to be $3^h\ 5^m\ 4^s$ while a solution of the spherical triangle by the analytical method with 4-place tables gave $3^h\ 5^m\ 12^s$ for the hour angle. During the hour that followed the observations just discussed nine additional sets of observations were made in the same way, sometimes with the same slit and occasionally with another. These observations were all reduced by the analytical method in order to learn the reliability of the altimeter. The average of all ten determinations of the longitude is $7^h\ 52^m\ 26^s$ west of Greenwich, while a large scale topographic map shows it to be $7^h\ 52^m\ 25^s$. The discrepancy between these values of the longitude amounts to only ¼ mile.

It will be understood that the graphical procedure numbered 5 above is really a simple method of solving a spherical triangle. The original chart, from which Figure 2 was copied, is much larger and more accurate. It was prepared by Dr. G. W. Littlehales while he was a member of the Staff of the Hydrographic Office of the U. S. Navy, and is extremely useful for purposes of navigation. For his gracious permission to reproduce the chart here the writer is most grateful to Dr. Littlehales. Acknowledgement is also due to Dr. F. E. Wright for calling attention to the wide applicability of this chart in an article published ten years ago in the *Journal of the Washington Academy of Sciences.**

Greater accuracy may be reached in the reduction of the observations for determining longitude by solving the spherical triangle in the usual analytical manner. For the benefit of readers proficient in trigonometric computation one method that may be followed is briefly outlined. The three sides of the spherical triangle are called a, b, c, and are given, while the Hour Angle which is sought is called A, and is the angle opposite the side a, the zenith distance of the sun. The other sides b and c are 90° minus the latitude and 90° minus the sun's declination, respectively.

We define an auxiliary quantity

$$s = (a + b + c)/2.$$

Then

$$\sin A/2 = \sqrt{\sin (s-b) \sin (s-c)/(\sin b \sin c)}.$$

Four place trigonometric tables are adequate for this computation, which is conveniently made with the aid of logarithms in a few minutes.

At a station whose latitude and longitude are known the altimeter may be used to determine the time from observations made exactly as though

Jour. Wash. Acad. Sciences, **14**, No. 17, Oct. 1924.

intended for finding the longitude. The only difference is in the details of the computation. Since the watch error is not supposed to be known it is omitted and instead the time actually indicated by the watch is used.

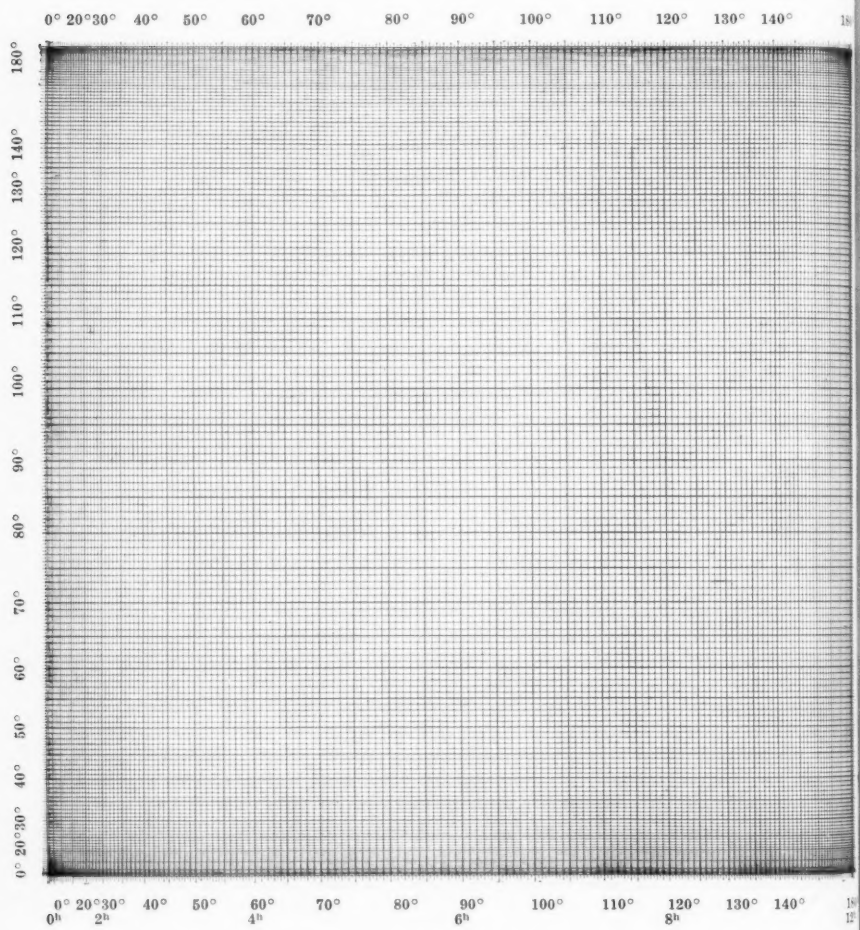

FIGURE 2.

LITTLEHALES' CHART FOR SOLVING SPHERICAL TRIANGLES.

Directions: Draw a straight line from $L - d$ on the left margin to $L + d$ on the right. Find the sun's zenith distance on left hand scale and follow a horizontal line from this point until it meets the line first drawn. From this intersection follow a vertical line to the bottom and read the time scale there. This is the sun's Hour Angle at the time of your observation. Reproduced by permission of Dr. G. W. Littlehales.

When the difference between the hour angle and the result of operation 7 is taken it will differ from the known correction to the standard meridian by just the amount of the watch error. Thus in the example on page 90-91 suppose watch time $3^h\ 10^m\ 39^s$ is used in operation 7. Then $3^h\ 10^m\ 39^s - 0^h\ 12^m\ 04^s = 2^h\ 58^m\ 35^s$ and 8 becomes: $3^h\ 5^m\ 36^s - 2^h\ 58^m\ 35^s = 7^m\ 1^s$. But supposing $7^m\ 52^s$ to have been the correct value we see here a difference of just 51^s which was our known watch error. In order to derive the correction to the watch with an accuracy of about 1 second it is necessary to take the average of about ten complete observations each of which is reduced by the analytical method, because the easier graphical method based on the chart is appreciably less accurate. This method of finding the time is not the one actually used by astronomers as the basis for our standard time, but is nevertheless of some interest because it does not require the highly specialized instruments regularly employed.

It is interesting to note that the same observations which are made with the altimeter for determining the longitude will also give the direction of true north, a result of primary importance. A simple extension of the application of the chart and a slight modification of the altimeter are the only requirements but these details cannot be included in the present article.

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A Note on the Magnitude of Nova Herculis

By DEAN B. McLAUGHLIN

The discovery of Nova Herculis on December 14 and the observation of a bright band spectrum at that early date raises a question whether the true maximum was missed. It is probably true that few people look at the constellations less than do the professional astronomers, and a second magnitude object might escape detection for some time. For several years I have systematically observed a number of bright variables, and on several nights during the few weeks before the discovery of the nova I observed variables in that part of the sky. The estimates were made with the aid of binoculars held in the hand; the place of observation was the roof of the observatory, where a good view of most of the sky could be had. In the following tabulation the variables observed are indicated by a star in the corresponding column opposite the date of observation.

I believe that on any of these occasions (with the possible exception of December 2, when the nova field was rather low) I would have noticed an object as bright as magnitude 2.0. Possibly a star as faint as 3.0 would have escaped notice, and 4.0 would surely have been missed. The chief point is that the three days immediately preceding discovery are pretty surely eliminated from the list of possible dates of

J. D.	Date 1934	X Her	g Her	R Lyr	β Lyr	AF Cyg
7770.52	Nov. 28					*
71.52	29			*		*
72.53	30					*
74.58	Dec. 2			*	*	*
83.47	11	*	*			*
84.00	12	Note				
85.50	13	*	*	*	*	*

NOTE: No observations of variables; I distinctly recall looking at Vega and the head of Draco just before dawn, as clouds were beginning to gather, but that region was clear.

a pre-discovery maximum. The same is true of a succession of three days about a fortnight before discovery. It is highly probable that the star was discovered during its first increase of light.

The following table gives observations made by me and by Dr. R. M. Petrie and Mr. Paul D. Jose. Original estimates are given to permit re-reduction with a different set of comparison star magnitudes. The magnitudes adopted for comparison stars are those of the *Revised Harvard Photometry*, as follows:

	M
a = γ Drac	2.42
b = γ Lyr	3.30
c = β Drac	2.99
d = ι Herc	3.79
e = ξ Drac	3.90

OBSERVATIONS OF NOVA HERCULIS

J. D.	Est.	Mag.	Obs.	J. D.	Est.	Mag.	Obs.
7789.46	a 3.5 N 6.5 b	2.73	Mc	7802.96	a 5 N 5 c	2.70	P
89.52	a 4.5 N 5.5 c	2.68	Mc	02.96	a 6 N 4 c	2.76	J
89.99	a 4 N 6 c	2.65	Mc	02.96	a 3.5 N 6.5 c	2.62	Mc*
95.52	N 0.5 a	2.4	Mc	04.47	a 5.5 N 4.5 c	2.73	Mc
95.93	N 1.0 a	2.3	Mc	04.51	a 7 N 3 c	2.82	Mc
98.46	c 5 N 5 e	3.44	P	04.97	a 5.5 N 4.5 c	2.73	Mc
99.44	a 3 N 7 c	2.59	Mc*	05.47	a 6.3 N 3.7 c	2.78	Mc
99.46	a 1 N 4 c	2.53	J	06.47	a 8.5 N 1.5 c	2.90	Mc
7799.46	a 3 N 7 c	2.59	P	07.47	a 6.5 N 3.5 c	2.79	Mc
7801.46	c 6.5 N 3.5 d	3.51	Mc*	07.88	a 7.8 N 2.2 c	2.86	Mc
7801.96	c 2 N 8 e	3.17	P	08.85	a 6 N 4 c	2.76	Mc
01.96	c 1 N 9 e	3.08	J	08.85	a 3.3 N 6.7 d	2.87	Mc
02.46	a 8 N 2 c	2.88	J	13.86	a 7.5 N 2.5 c	2.85	Mc
02.46	a 9 N 1 c	2.93	P	14.90	a 4 N 6 c	2.65	Mc
02.49	a 9 N 1 c	2.93	Mc*	18.99	a 7± N 3± c	2.8:	Mc

The asterisks in the observer column indicate observations made at Philadelphia and Princeton. All others were made at Ann Arbor.

The leisurely rise to maximum, the long duration of brightness not much below maximum, and the behavior of the spectrum to date show a rather striking parallel with the behavior of Nova Pictoris (1925). The "simmering stage," to use Lunt's very apt expression, was represented by a spectrum of P Cygni type in both cases. The explosion, giving rise to the first large increase of displacement, occurred about at the time of light maximum, probably December 24.

OBSERVATORY, UNIVERSITY OF MICHIGAN, JANUARY 16, 1935.

The Eclipse of February 3, 1935— A Partial Solar Eclipse Visible in Central America

By ALEXANDER POGO

Partial eclipses constitute more than one-third—about 35.3 per cent—of all the solar eclipses. Their visibility varies considerably with the latitude, decreasing from the polar circles to the equator; statistics concerning solar eclipses visible in historically important areas of our globe, with special reference to the Maya territory, will appear elsewhere; for the purposes of the present paper, Table I will suffice. The table is based

TABLE I

STATISTICS OF SOLAR ECLIPSES OF CLASSICAL ANTIQUITY (900 B.C. TO A.D. 600).

Mediterranean-Mesopotamian area			Northern hemisphere	——Earth in general——		
			Percentages of			
Groups		eclipses within groups	ca 635 northern partial	1268 partial	2309 total	3577 solar
Conspicuous partial	39	8	6	3		1
Conspicuous central	446	92			19	12½
Conspicuous solar	485	100				13½
Small partial	ca 75	38	12	6		2
Small central	ca 120	62			5	3½
Small solar	ca 195	100	—	—	—	5½
Visible partial	ca 115	17	18	9		3
Visible central	ca 565	83			24	16
Visible solar	ca 680	100				19

on Oppolzer's[1] and on Ginzel's[2] data, and shows that 18 per cent of the partial solar eclipses which swept over the northern hemisphere, between 900 B.C. and A.D. 600, were visible in the Mediterranean-Mesopotamian area, and that the percentage of northern partial eclipses conspicuous in this area amounted to 6; Ginzel's charts cover the longitudes 10° W to 55° E (Greenwich), and the latitudes 25° to 50° N. In higher latitudes, larger percentages of northern partial solar eclipses are visible and are conspicuous, and the ratio of conspicuous partial to conspicuous central eclipses also increases; Schroeter's[3] 300 excellent charts show the conditions of visibility of 300 central eclipses of the sun which occurred between longitudes 30° W and 75° E, and between latitudes 30° and 70° N, during the twelve centuries following A.D. 600; the unjustified omis-

[1] Canon der Finsternisse. Denkschriften d. Akad., math.-naturw. Cl., Bd. 52, Wien 1887.

[2] Spezieller Kanon der Sonnen- und Mondfinsternisse. Berlin 1899.

[3] Spezieller Kanon der zentralen Sonnen- und Mondfinsternisse. Kristiania 1923.

sion of the partial eclipses limits the usefulness of Schroeter's *Kanon* for chronological and astronomical inestigations based on mediaeval data.

It is to be regretted that a recent investigation of eclipses visible in the Maya territory was based on a table which was supposed "to insure the inclusion of all eclipses that could possibly be visible in the region considered,"[4] but which did not include a single partial eclipse due to the unjustified assumption that "no part of the shadow (read: penumbra) of such an eclipse can reach so far south as the latitude of Yucatan and the eclipse should not be included in our table."[5] The very nature of the problem presented by the Maya table of ecliptic syzygies, preserved on pages 51 to 58 of the Dresden Codex, requires a study of the patterns

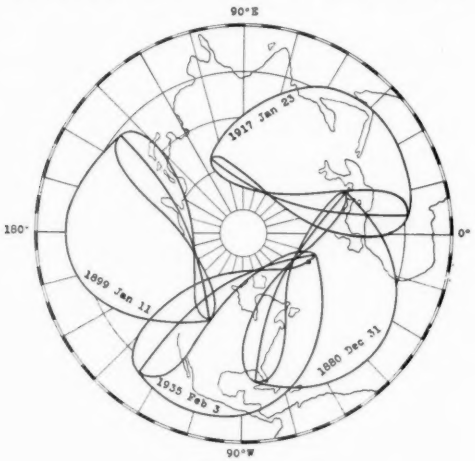

FIGURE 1.
PARTIAL ECLIPSES NOS. 13 TO 16 OF THE ASCENDING-NODE SAROS CYCLE RUNNING SINCE 1664 AUGUST 21.

formed by "all eclipses that could possibly be visible" in the Maya territory—and this includes, incidentally, not only partial eclipses of the sun but also lunar eclipses; these matters, and their bearing on the problem of correlating Maya and Christian dates, will be discussed elsewhere.

Partial eclipses of the sun visible in Central America, or, more generally, in low northern latitudes, belong to two groups: in the case of ascending-node saros cycles, they precede the series of central eclipses; in the case of descending-node saros cycles, they follow the central eclipses which form the exeligmos loops north of the equator. The eclipse of 1935 February 3 belongs to the first group, the eclipse of 1892

[4] Robert W. Willson. Astronomical notes on the Maya codices. Papers of the Peabody Museum, Harvard University, vol. VI, no. 3, 11, Cambridge, Mass. 1924.
[5] *Loc. cit.*, 12.

FIGURE 2.
ANNULAR ECLIPSES NOS. 48 TO 50 OF THE DESCENDING-NODE SAROS CYCLE RUNNING SINCE 991 APRIL 17.
Note: The sunrise loops have been omitted in this sketch.

FIGURE 3.
PARTIAL ECLIPSES NOS. 51 TO 53 OF THE DESCENDING-NODE SAROS CYCLE RUNNING SINCE 991 APRIL 17.

October 20 belongs to the second; these two partial eclipses visible in the Maya territory—see the sketches of Figures 1 and 3—may be considered as members of two consecutive Maya eclipse cycles (Mecs) of 11960 days or 405 lunations. A glance at Figures 2 and 3 shows that it is inconsistent to include, in a *Kanon* of European mediaeval eclipses or in a table of solar eclipses visible in the Maya territory, central eclipses while omitting partial ones. The circumstance that the eclipses Nos. 48, 49, and 50 of Table III become annular, at sunset, in the limited regions indicated by the paths of the annuli, does not change the fact that they were visible in their partial phases only everywhere else within the limits of the penumbra; thus, for practically the entire area common to eclipses Nos. 48 and 51, 49 and 52, and 50 and 53, respectively, there was a repetition of about the same phases of a partial eclipse after the lapse of an exeligmos (19756 days or 54 years and 1 month). Incidentally, a northern partial eclipse immediately following the end of the series of central eclipses of a descending-node saros cycle may be visible even south of the equator—the southern limit of simple contact of the eclipse of 1892 October 20 reached the Lower Amazon.

TABLE II

NORTHERN SERIES OF PARTIAL ECLIPSES OF THE SAROS CYCLE RUNNING SINCE 1664 AUGUST 21.

1	p	1664	Aug.	12.4	9	p	1808	Nov.	18.1	17	p	1953	Feb.	14.0
2	p	1682	Sept.	1.7	10	p	1826	Nov.	29.5	18	p	1971	Feb.	25.4
3	p	1700	Sept.	13.0	11	p	1844	Dec.	9.8	19	p	1989	Mar.	7.8
4	p	1718	Sept.	24.4	12	p	1862	Dec.	21.2	20	p	2007	Mar.	19.1
5	p	1736	Oct.	4.7	13	p	1880	Dec.	31.6	21	p	2025	Mar.	29.5
6	p	1754	Oct.	16.0	14	p	1899	Jan.	11.9	22	(t)	2043	Apr.	9.8
7	p	1772	Oct.	26.4	15	p	1917	Jan.	23.3	23	t	2061	Apr.	20.1
8	p	1790	Nov.	6.8	16	p	1935	Feb.	3.7	24	t	2079	May	1.5

TABLE III

PART OF THE SAROS CYCLE RUNNING SINCE 991 APRIL 17.

48	a	1838	Sept.	18.9	51	p	1892	Oct.	20.8		
49	a	1856	Sept.	29.2	52	p	1910	Nov.	2.1		
50	a	1874	Oct.	10.5	53	p	1928	Nov.	12.4		

Table II shows that the eclipse of 1935 February 3 is the 16th of an ascending-node major saros cycle; the partial eclipses of this saros cycle occur, in the XIXth and XXth centuries, in the winter-solstice arc of the ecliptic; with the North Pole turned away from the sun, and with the eclipsing moon far from the node, north of the ecliptic, the southern limit of the oblique penumbra reaches low latitudes in that part of the northern hemisphere which happens to be exposed to the winter sun. The first total eclipse of our saros cycle will occur on April 9, 2043; it will not, however, be central—when the oblique umbra touches, at sunrise, the northeastern tip of Asia, the axis of the cone, *i.e.* the line joining the centers of the eclipsed sun and of the eclipsing moon, will pass above the surface of our globe. The first central eclipse of our saros cycle visible in the United States is not due until 2079 May 1—almost exactly two centuries after the partial eclipse of 1880 December 31

which was visible in Florida; it will be a total eclipse of the midnight sun near the North Pole, with a sunrise point of totality off the New Jersey coast; it will not be visible in Central America.

The eclipse of 1935 February 3 will be visible in Yucatan, weather permitting, between 9:00 and 10:00 A.M., local mean time.

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DECEMBER 20, 1934.

Planet Notes for March, 1935

By CLIFFORD E. SMITH

The *Sun* will be moving with an apparent northeasterly motion from the central part of Aquarius to the central part of Pisces. On March 21 at $7^h\,18^m$ A.M., the sun will be at the Vernal Equinox, and this event officially marks the beginning of spring. At the beginning of the month, the distance from the earth to the sun will be about 92.05 million miles, and this distance will increase about 0.75 million miles during the month. The position of the sun on the first and last days of the month will be, respectively: R.A. $22^h\,44^m$, Decl. $-8°\,1'$, and R.A. $0^h\,34^m$, Decl. $+3°\,42'$.

The phenomena of the *Moon* will occur as follows:

New Moon	March	4 at	9 P.M.
First Quarter		11 "	7 P.M.
Full Moon		19 "	12 P.M.
Last Quarter		27 "	3 P.M.
Perigee		4 "	6 A.M.
Apogee		16 "	11 P.M.

Mercury will be a morning object rising somewhat more than an hour before the sun. It will be moving with an apparent easterly motion from the eastern part of Capricornus to the eastern part of Aquarius. Its distance from the earth will increase from about 66 to about 105 million miles; the corresponding change in apparent diameter will be from about 9.4 to about 5.9 seconds of arc. On March 15 at 1:00 P.M., Mercury will be at greatest elongation west (27° 37′). Conjunction with the moon will occur on March 3 at 6:00 A.M. (Mercury 6′ S), and conjunction with Saturn will occur on March 22 at 3:00 A.M. (Mercury 19′ S). It will be noted that these conjunctions are rather close conjunctions. The position of Mercury on the first and last days of the month will be as follows: R.A. $21^h\,22^m$, Decl. $-13°\,11'$, and R.A. $23^h\,12^m$, Decl. $-7°\,42'$.

Venus will be an evening object setting about two hours after the sun, and it will be moving with an apparent easterly motion from the central part of Pisces to the central part of Aries. At the beginning of the month, the distance from the earth to Venus will be about 140 million miles, and the corresponding apparent diameter will be about 11 seconds of arc. By the end of the month this distance will have decreased to about 125 million miles, and the apparent diameter will have increased to about 12.4 seconds of arc. On March 22 at 1:00 A.M., Venus will be in conjunction with Uranus (Venus 24′ N), and on March 6 at 9:00 P.M., it will be in conjunction with the moon (Venus 6°.2 S).

Mars will be a night object in Virgo, some four or five degrees in a northerly direction from Spica. At the end of the month it will be above the horizon prac-

tically all night, since opposition with respect to the sun will be only a week away. At the beginning of the month, the distance from the earth to Mars will be about 75 million miles, and this distance will decrease about 15 million miles during this period. The corresponding change in apparent diameter will be from 11.8 seconds of arc to about 14.7 seconds of arc. Conjunction with the moon will occur on March 22 at 2:00 A.M. (Mars 8°6 N).

Jupiter will be a morning object in eastern Libra. During the middle of the month its distance from the earth will be about 450 million miles, and its apparent diameter will be about 38 seconds of arc. At this time it will be on the meridian about 4:00 A.M., Standard Time. It will be in conjunction with the moon on March 24 at 11:00 A.M. (Jupiter 6°0 N).

Saturn will be a morning object in central Aquarius, but it will be too near the sun to be of interest, since conjunction with the sun will have occurred late in February.

Uranus will be an evening object in the extreme eastern part of Pisces. During the middle of the month it will set about two hours after the sun. There will be a rather close conjunction with Venus on March 22 at 1:00 A.M. (Uranus 24′ S). Uranus, however, will be too near the sun to be of much interest. Conjunction with respect to the sun will occur next month.

Neptune will be a night object in Leo about a degree in a southerly direction from χ Leonis. It will be above the horizon most of the night hours during the month, since opposition will occur on March 4 at 11:00 A.M. Its distance from the earth will be about 2700 million miles, and its apparent diameter will be about 2½ seconds of arc. Conjunction with the moon will occur on March 18 at 8:00 P.M. (Neptune 5°0 N). Its position on March 15 will be R.A. $10^h\ 59^m$, Decl. $+7°\ 37'$.

Variable Stars

Monthly Report of the American Association of Variable Star Observers for December, 1934

The event of particular importance to variable star observers since the last report has been the appearance of the bright Nova in Hercules, discovered by J. P. M. Prentice, probably on December 12, 1934. Word was received in America via radio and cable on December 13 and 14, thus enabling observations to be secured on the fourteenth. A provisional blue print chart on the Harvard Photo-Visual System was issued at once to about one hundred observers and, save for December 16, observations have been obtained on every night up to January 5, inclusive.

The Nova steadily increased in magnitude from December 14 to 22, when it attained magnitude 1.3. Since then it has decreased in brightness, but subject to marked irregularities. In its general behavior the Nova has striking resemblances to Nova Geminorum, 1912.

A b type chart of the field of Nova Herculis is being prepared and will be issued to observers at the earliest possible moment.

According to a recent observation, R Coronae Borealis has attained magnitude 8.7, after having dropped to 10.4 in December.

VARIABLE STAR OBSERVATIONS RECEIVED DURING DECEMBER, 1934.

Oct. 0 = J.D. 2427711; Nov. 0 = J.D. 2427742; Dec. 0 = J.D. 2427772.

J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.
V Scl	T Cas	Y Cep	V And	W Cas	R Scl
000339	001755	003179	004435	004958	*012233a*
720[13.3 Bl	656 8.1 Fc	724 14.5 Pd	655 13.5 Fc	777 11.8 Jo	770 8.2 Kd
738[13.3 Bl	746 9.1 Ah	781 12.1 Ie	667 14.0 Fc	781 11.7 Bs	777 8.3 Kd
S Scl	747 8.4 Pk	U Cas	729 13.8 Bm	783 11.9 Jo	RZ Per
001032	748 9.6 Hk	004047a		783 11.9 Pt	012350
720 6.3 Bl	748 8.8 Sq	644[13.3 Fc	RR And	U Tuc	640 10.6 Fc
737 6.7 Ht	751 9.5 Ah	660[14.4 Fc	004533	*005475*	656 10.2 Fc
738 6.3 Bl	751 9.2 Hf	745 9.0 Ko	601 11.2 Bm	718 8.8 Sl	660 10.3 Fc
738 6.5 dK	753 8.8 Jo	747 8.7 Pf	639 11.3 Fc	720 8.5 Bl	753 9.6 Io
745 6.5 dK	756 8.8 Pk	747 9.1 Hi	654 9.3 Fc	738 8.3 Bl	756 9.8 Jo
746 6.6 Ht	766 8.7 Dl	748 8.6 Bc	659 9.1 Fc	746 8.4 Ht	758 9.5 B
751 6.5 dK	766 8.2 Wh	748 9.2 Hk	667 8.8 Fc	749 8.4 En	758 10.1 Wp
755 6.8 Kd	767 10.0 Gy	748 8.5 Hv	675 9.2 Bm	755 8.7 Ht	760 9.7 Wp
757 6.8 dK	768 10.6 Sx	749 9.2 Hu	703 9.6 Bm	Z Cet	760 9.7 Wa
767 7.3 dK	773 10.1 Ah	750 8.7 Hv	717 10.5 Fc	*010102*	772 10.2 Gy
770 7.5 Kd	774 9.6 Hf	750 8.7 Bc	729 11.0 Bm	657 11.6 Fc	774 10.1 Wa
780 7.5 Kd	775 9.5 Ra	750 9.1 Wu	RV Cas	748 11.0 Hi	774 10.2 Wp
X And	776 9.9 Wd	751 8.9 Hv	004746a	751 10.9 Hf	776 9.9 Wp
001046	776 9.4 My	751 9.1 Hf	747 11.1 Ar	753 10.0 Jo	776 10.0 Wa
601 11.5 Bm	777 9.6 Jo	752 8.5 Pf	747 10.5 Pf	767 9.5 Jo	R Psc
639 12.4 Fc	783 9.9 Jo	753 8.8 Bc	748 11.0 Ar	769 9.7 Sx	012502
644 12.6 Fc	783 11.0 Pt	753 8.8 Hv	752 11.6 Pf	774 9.4 Hf	601 11.9 Bm
654 12.8 Fc	R And	753 8.7 Jo	753 11.2 Ar	776 9.1 Hz	675 7.6 Bm
659 13.0 Fc	001838	756 8.8 Bc	753 10.2 Jo	779 9.0 Jo	729 10.6 Bm
667 13.2 Fc	639 8.8 Fc	756 8.8 Hv	755 11.3 B	782 9.2 Sx	748 11.5 Cl
703[12.0 Bm	654 9.2 Fc	757 9.5 Bs	783 13.0 Pt	U Scl	753 11.6 Jo
716[12.5 Fc	659 9.1 Fc	758 8.8 Hv	— Cas	*010630*	767 12.5 Jo
729 13.4 Bm	667 9.3 Fc	765 9.1 Hi	004746b	720 12.7 Bl	776 12.2 Hz
747 14.7 Pf	744[11.6 Sz	767 9.1 Sf	753 10.4 Jo	738 11.5 Bl	781[10.3 Dl
767 14.5 Ie	770 11.6 Ra	767 8.3 Hm	W Cas	U And	RU And
T Cet	781[10.6 Dl	768 9.0 Lt	004958	010940	013238
001620	S Tuc	768 9.7 Sx	640 9.3 Fc	659 13.3 Fc	748 11.6 Ar
750 6.4 Lt	*001862*	768 9.0 Wh	644 9.3 Fc	668 13.1 Fc	749 11.4 Wu
757 6.5 Lt	720 10.0 Bl	770 9.7 Ra	656 9.5 Fc	753 9.6 Jo	753 11.9 Jo
763 6.5 Lt	738 10.3 Bl	770 9.4 Hi	716 11.1 Fc	UZ And	755 10.0 B
772 6.3 Lt	739 10.6 dK	773 9.3 Hf	743 11.1 Af	011041	756 11.3 Jo
772 6.5 Kd	745 10.6 dK	774 8.4 Hm	743 11.1 Fr	639 11.2 Fc	766 11.2 Bs
778 6.5 Kd	746 11.2 Ht	777 8.5 Hm	744 11.1 Fr	659 13.0 Fc	778 10.9 Md
780 6.5 Kd	749 10.9 En	777 9.8 Hf	745 11.7 Ko	667 13.0 Fc	783 10.5 Pt
T And	751 10.9 dK	777 9.8 Wd	748 11.2 Hk	748 15.6 Ar	Y And
001726	755 11.1 Ht	777 9.7 Jo	748 11.1 Fr	S Psc	013338
639 13.8 Fc	757 11.1 dK	777 9.9 Sf	750 11.4 Pb	011208	748 14.6 Ar
654[14.0 Fc	767 11.9 dK	780 8.6 Hm	751 11.3 Af	657[13.9 Fc	783 13.5 Pt
667[14.0 Fc	S Cet	782 10.0 Sx	751 11.1 Fr	753 10.4 Jo	X Cas
737 10.9 Es	*001900*	783 9.9 Pt	753 11.1 Pb	767 9.4 Jo	014958
747 10.5 Hi	656 12.0 Fc	RW And	753 12.0 Jo	781 10.3 Bj	748 12.0 Wu
751 10.9 Hf	657 12.1 Fc	004132	754 11.0 Pb	S Cas	777 12.0 Bs
753 9.9 Jo	772 13.4 Hi	639 9.3 Fc	755 11.1 B	011272	783 11.8 Pt
765 9.5 Hi	783[12.3 Pt	654 9.9 Fc	756 11.2 Pb	640[13.0 Fc	U Per
766 9.2 Bs	T Phe	659 10.4 Fc	756 11.0 Fr	656[13.9 Fc	015254
768 9.3 Lt	*002546*	667 10.7 Fc	757 11.2 Fr	767 14.1 Ie	744 10.1 Ry
773 9.4 Hf	720[13.6 Bl	716 12.7 Fc	757 11.0 Pb	777 13.4 Wa	748 10.3 Sq
777 9.2 Hf	746[13.0 Ht	RX Cep	757 11.4 Bs	777 13.5 Wp	753 10.6 Ry
777 9.2 Wd	W Scl	004281	758 11.1 Fr	U Psc	753 10.5 Jo
778 8.6 Md	*002833*	757 7.3 Lt	758 10.9 Pb	011712	758 10.4 B
780 8.8 Jo	720 13.0 Bl	V And	770 11.1 Fr	657 11.3 Fc	767 11.0 Ba
783 8.7 Jo		004435	770 11.0 Ra	770 12.5 Fc	767 10.3 Jo
783 9.0 Pt		601 10.8 Bm	776 11.5 Wd		772 11.2 Ry
		639 13.2 Fc	776 11.8 My		773 11.0 Wa

VARIABLE STAR OBSERVATIONS RECEIVED DURING DECEMBER, 1934.

J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.
U PER	o CET	o CET	S PER	R TRI	W PER
015254	*021403*	*021403*	021558	023133	024356
773 11.3 Wp	743 7.7 Lu	774 4.7 Kg	758 9.5 Lu	779 9.7 Pv	757 10.3 Fr
774 11.0 Hf	743 7.5 Rb	774 4.7 Rb	763 9.2 Jo	780 9.7 Jo	758 10.1 Fr
774 11.4 Ba	744 7.2 Rb	775 4.4 Ra	765 9.3 Pk	781 9.4 Bj	758 9.7 B
776 11.0 My	744 7.0 Ah	777 4.0 Dl	766 9.4 Cm	782 9.5 Sx	758 10.0 Wp
780 11.0 Ba	746 6.9 Ah	777 4.4 Hm	766 9.4 Dl	783 9.4 Pv	760 9.8 Wp
783 10.7 Pt	748 7.0 Hf	777 4.4 Hf	767 9.2 Fs	792 9.1 Pv	760 9.8 Wa
XX PER	748 7.2 Rb	777 4.7 Kd	767 9.6 Lu	798 8.5 Pv	762 9.3 Ra
015654	748 6.6 Bc	777 4.2 Sx	768 9.3 Sx	T ARI	767 9.5 Jo
753 8.5 Lt	748 6.6 Hv	777 4.4 Wd	769 9.2 Pk	024217	768 10.2 Wh
757 8.5 Lt	749 6.2 Sq	777 4.5 Jo	770 9.4 Fr	743 9.7 Af	769 10.8 Sx
767 8.4 Lt	749 7.0 Rb	778 3.9 Dl	770 9.4 Af	743 9.6 Fr	770 10.1 Fr
R ARI	750 6.3 Bc	778 4.5 Kg	772 9.2 Fc	744 9.4 Ko	771 10.1 Mc
021024	750 6.4 Hv	779 4.4 Jo	773 9.3 Hf	748 9.7 Fr	772 10.0 Ry
748 12.1 Af	751 6.9 Lu	779 4.1 Gl	774 9.2 Dl	748 9.7 Af	773 9.6 Hf
748 12.4 Fr	751 6.8 Ah	779 4.2 Ra	776 9.4 Ra	749 9.4 Hu	774 10.3 Wa
756 12.3 Fr	751 6.7 Hf	779 4.1 Sx	776 8.8 My	753 9.5 Jo	774 10.0 Wp
756 12.8 Pb	751 6.8 Rb	780 3.9 Ba	777 8.8 Jo	756 9.6 Pb	776 10.1 Wa
757 12.8 Fr	753 6.2 Bc	780 3.8 Dl	778 9.2 Dl	756 9.0 Hv	776 9.9 My
783 11.1 Pt	753 6.6 Fs	780 3.9 Hm	780 9.2 Kg	756 9.0 Bc	776 10.0 Wp
W AND	753 6.2 Hv	780 4.2 Hf	780 8.9 Jo	757 9.6 Fr	776 10.0 Mc
021143a	753 6.4 Jo	780 4.1 Kd	783 9.3 Wd	757 9.3 Hu	777 9.6 Jo
745 8.7 Ko	753 6.2 Si	780 4.1 Gl	783 8.8 Pt	763 8.7 Jo	777 9.8 Pt
745 9.1 Ah	754 6.1 Si	780 4.2 Kg	783 9.3 Dl	766 9.6 Bs	783 9.3 Pv
746 9.2 Ah	754 6.4 Kd	780 4.1 Rb	R CET	769 9.3 Sx	792 9.0 Pv
753 9.3 Jo	754 6.6 Ah	780 3.9 Sf	*022000*	773 9.2 Hf	798 9.0 Pv
756 9.4 Jo	756 5.9 Bc	781 3.7 Dl	748 11.5 Hi	776 9.1 Hz	R HOR
773 9.7 Ah	756 5.9 Hv	781 3.9 Hm	776 12.3 My	777 9.0 Jo	*025050*
773 9.8 Hf	756 6.5 Dl	781 4.0 Gl	783 9.5 Jo	780 8.7 Jo	719 6.6 Sl
781 9.7 Bj	756 6.7 Rb	781 4.0 Ra	RR PER	783 8.7 Jo	720 7.0 Bl
783 9.7 Pt	756 6.2 Kd	781 4.0 Rb	022150	W PER	738 7.7 Bl
T PER	757 6.4 Kg	781 4.0 Sx	750 12.2 Wu	024356	738 7.3 dK
021258	758 5.6 Lu	781 3.9 Gy	783 10.0 Pt	743 10.4 Fr	745 7.9 dK
743 9.0 Lu	758 6.2 Kd	782 4.0 Gl	R FOR	743 10.3 Af	746 8.2 Ht
743 9.3 Cl	759 6.0 Hm	783 4.0 Gl	*022426*	744 10.4 Fr	749 8.7 En
748 8.6 Sq	764 5.8 Kd	783 3.8 Kd	720 12.0 Bl	744 9.3 Ko	751 7.9 dK
748 8.8 Hf	765 5.0 Jo	783 3.8 Hm	738 12.4 Bl	744 10.1 Ry	755 8.4 Ht
749 8.9 Cl	766 5.3 Sf	783 3.7 Dl	776 12.9 Bj	748 9.8 Bc	757 8.1 dK
750 9.1 Lt	766 5.4 Sx	783 4.2 Jo	U CET	748 9.3 Fr	764 8.5 dK
751 8.9 Lu	766 5.3 Rb	790 2.5 C	*022813*	748 9.8 Hv	T HOR
752 9.1 Lt	766 5.4 Hf	S PER	776 13.0 Bj	748 9.3 Dh	*025751*
753 8.6 Jo	766 5.4 Hm	021558	RR CEP	749 10.1 Ry	720 13.3 Bl
758 9.0 Lu	766 5.4 Dl	743 9.4 Lu	022980	750 10.1 Bc	746 13.3 Ht
766 9.3 Cm	767 5.5 Fs	743 9.0 Cl	781 13.3 Ie	750 10.0 Hv	755 12.9 Ht
767 9.0 Lu	767 4.6 Lu	744 9.4 Sz	R TRI	751 10.4 Af	ρ PER
767 8.5 Jo	767 5.0 Ba	745 9.4 Hr	023133	751 10.3 Fr	025938
768 9.0 Sx	767 5.2 Dl	747 9.2 Pk	746 11.5 Ah	751 10.1 Hv	772 3.4 Lt
769 9.4 Pk	767 5.4 Hm	748 8.8 Sq	748 11.7 Dh	751 9.7 Hf	U ARI
773 8.8 Hf	770 4.5 Sx	748 9.3 Hf	748 11.7 Hk	753 10.3 Af	030514
776 9.0 Ra	770 4.6 Ra	749 8.9 Cl	748 11.4 Hf	753 10.1 Bc	675 9.2 Bm
777 8.5 Jo	770 5.1 Kd	750 9.2 Pk	749 11.3 Hu	753 10.1 Hv	716 11.2 Bm
780 9.1 Kg	771 5.0 Kd	751 9.6 Lu	755 11.1 B	753 10.3 Pb	727 11.8 Bm
783 8.8 Pt	772 4.5 Sx	752 9.6 Hk	772 10.5 Sx	753 10.1 Ry	X CET
783 9.0 Wd	772 4.9 Kd	753 9.6 Pb	773 9.6 Hf	753 9.6 Jo	*031401*
783 8.5 Jo	773 4.9 Ah	753 9.2 Jo	773 10.0 Ah	756 9.9 Bc	748 8.8 Bc
Z CEP	773 4.8 Hf	753 9.3 Fs	777 9.7 Hf	756 10.3 Fr	748 8.8 Hv
021281	774 5.0 Ba	756 9.6 Fr	777 9.6 Wd	756 9.8 Hv	749 8.9 Hu
783 12.5 Pt	774 4.9 Hm	756 9.4 Pb	777 9.9 Jo	756 10.3 Pb	750 8.8 Bc
	774 4.8 Hf	757 9.4 Fr	777 9.7 Sf	756 9.5 Jo	750 8.8 Hv

VARIABLE STAR OBSERVATIONS RECEIVED DURING DECEMBER, 1934.

J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.
X CET			**R PER**			**R TAU**			**T CAM**			**AB AUR**			**S PIC**		
031401			032335			042209			043065			044930			*050848*		
753	8.8	Bc	756	12.0	Jo	777	12.2	Cm	774	9.0	Hf	772	7.0	Lt	755	10.9	Ht
753	8.8	Hv	766	12.6	Bs	777	11.9	B	777	8.9	Dl	**R ORI**			**R AUR**		
753	9.3	Jo	776	13.2	My	780	11.9	Es	777	8.8	Jo	045307			050953		
756	8.8	Hv	776	12.6	Ra	780	11.8	Md	777	9.1	Sx	751	11.5	Ko	767	13.1	Wa
756	8.8	Bc	**NOV PER**			783	11.0	Pt	777	9.3	Wd	753	10.8	Jo	767	13.0	Wp
757	8.9	Hu	032443			**W TAU**			777	9.0	Wh	774	10.9	Sf	775	13.2	Pt
766	9.0	Sx	748	12.9	Ar	042215			780	9.0	Dl	777	10.6	Cm	778	13.7	Bs
766	9.2	Bs	753	13.0	Ar	743	10.4	Dh	780	8.9	Jo	779	10.0	Jo	**T PIC**		
767	9.3	Sf	757	13.2	Ar	747	10.3	Dh	782	8.8	Hz	783	10.0	Jo	*051247*		
767	9.7	Jo	770	13.0	Ar	747	10.3	Ar	783	9.2	Pt	**R LEP**			738	13.1	Bl
772	9.4	Fc	772	12.7	Gy	748	10.3	Af	783	9.2	Jo	*045514*			746	13.1	Ht
776	8.8	Hz	777	13.1	Pt	748	10.3	Dh	**RX TAU**			745	6.1	Ko	**NOV TAU**		
776	9.0	My	**U CAM**			748	10.3	Fr	043208			747	7.5	Kp	051316		
776	9.4	Bj	033362			749	10.4	Dh	748	13.4	Ar	748	6.5	Hv	748	15.1	Ar
777	9.5	Sf	753	7.5	Jo	749	10.6	Hu	774	12.4	Rb	748	6.5	Bc	753	14.7	Ar
777	9.9	Jo	767	7.6	Jo	751	10.0	Ko	777	12.5	B	749	6.8	Rq	757	14.4	Ar
779	10.3	Jo	774	8.5	Hf	752	10.5	Af	780	11.8	Es	749	7.2	Si	**T COL**		
781	10.5	Ba	777	7.7	Jo	754	10.5	Pb	783	12.5	Pt	753	6.2	Bc	*051533*		
782	9.5	Sx	783	7.7	Jo	756	10.6	Pb	**R RET**			753	6.2	Hv	738	8.2	Bl
783	10.3	Jo	**U ERI**			756	10.5	Fr	*043263*			753	7.0	Si	739	7.7	dK
Y PER			*034625*			757	10.7	Fr	719	10.7	Sl	754	6.1	Jo	745	7.7	dK
032043			756	8.8	Jo	757	10.6	Hu	720	10.9	Bl	756	6.0	Bc	746	8.3	Ht
744	8.5	Ko	774	9.4	Wa	757	10.6	Pb	738	9.0	Bl	756	6.0	Hv	751	8.0	dK
746	9.7	Ah	774	9.3	Wp	758	10.3	Dh	746	8.5	Ht	766	8.1	Hf	755	8.4	Ht
747	9.5	Pk	776	10.0	Wp	766	10.6	Bs	755	7.6	Ht	772	7.3	Ra	757	8.1	dK
748	9.3	Sq	776	9.8	Wa	767	10.4	Jo	**X CAM**			772	8.0	Sx	767	8.7	dK
748	9.1	Bc	**X PER**			767	10.6	Ba	043274			773	8.1	Hf	**S AUR**		
748	9.1	Hv	034930			770	10.6	Fr	751	12.7	Ko	775	7.0	Pt	052034		
750	9.1	Hv	757	6.3	Lt	772	10.6	Fc	766	13.8	Bs	779	7.0	Jo	743	9.2	Rb
750	9.2	Bc	765	6.3	Lt	774	10.6	Rb	782	12.6	Hz	780	8.4	Dl	744	8.7	Ko
751	9.6	Hf	771	6.1	Mc	774	10.9	Ba	783	13.0	Pt	781	8.4	Dl	747	8.7	Pk
753	9.6	Jo	772	6.4	Lt	776	10.6	My	**R DOR**			781	7.0	Bj	747	10.1	Ho
753	9.1	Bc	776	6.6	Mc	777	10.5	Jo	*043562*			783	7.6	Hm	748	9.4	Hf
753	9.1	Hv	778	6.7	Mc	778	10.6	Md	719	5.8	Sl	783	7.3	Jo	751	8.8	Sq
756	9.1	Hv	**T ERI**			780	10.9	Rb	720	6.0	Bl	**V ORI**			751	9.2	Rb
756	9.1	Bc	*035124*			780	11.0	Es	738	5.8	Bl	050003			753	8.9	Jo
758	9.2	B	749	9.7	Hu	780	10.9	Md	746	5.7	Ht	675	13.4	Bm	756	9.2	Rb
765	8.8	Pk	756	9.9	Jo	780	10.6	Jo	755	5.7	Ht	716	14.0	Bm	766	9.2	Rb
766	9.0	Bs	757	10.3	Hu	780	11.0	Ba	**R CAE**			727	13.8	Bm	766	9.0	Sq
767	8.8	Jo	780	11.3	Bj	780	10.6	Hf	*043738*			767	13.7	Wa	767	9.8	Ba
771	9.2	Mc	**W ERI**			783	10.8	Pt	738	11.1	Bl	774	13.0	Cm	767	9.1	Pk
772	9.1	Sx	*040725*			**S TAU**			746	10.7	Ht	775	11.7	Pt	767	8.9	Jo
772	9.2	Fc	751	12.0	Ko	042309			755	10.1	Ht	**T LEP**			767	9.4	Dl
773	9.0	Ah	**T TAU**			675	11.6	Bm	**R PIC**			*050022*			767	9.8	Wa
774	9.3	Hf	041619			716	10.6	Bm	*044349*			675	13.1	Bm	767	9.6	Wp
776	9.0	Mc	675	10.2	Bm	727	10.8	Bm	724	8.7	Bl	716	10.8	Bm	769	9.4	Pk
776	9.6	Ra	716	10.4	Bm	748	12.6	Ar	738	7.5	Bl	727	11.0	Bm	772	10.0	Ra
776	8.5	Wh	727	10.7	Bm	748	12.3	Hi	736	8.6	Ht	733	10.9	Bm	772	9.3	Fc
777	8.5	Pt	**R TAU**			751	12.2	Ko	755	8.7	Ht	738	11.5	Bl	772	9.5	Sx
777	9.0	Jo	042209			766	12.9	Bs	**V TAU**			773	11.6	Wa	774	9.7	Rb
780	8.9	Jo	675	12.5	Bm	783	12.0	Pt	044617			773	11.6	Wp	774	9.8	Ba
798	8.5	Pv	716	14.5	Bm	**T CAM**			752	12.5	Hk	775	11.6	Pt	774	9.6	Hf
R PER			727	13.7	Bm	043065			777	11.2	B	780	11.1	Bj	775	8.5	Pt
032335			748	13.1	Ar	744	8.2	Ko	783	10.6	Jo	**S PIC**			776	9.2	My
743	10.7	Cl	748	12.1	Hi	753	8.2	Jo	**AB AUR**			*050848*			777	10.1	Wd
749	11.7	Cl	751	12.6	Ko	766	8.5	Hm	044930			724	10.0	Bl	777	9.2	Jo
753	11.7	Jo	766	12.5	Bs	767	8.5	Jo	757	7.0	Lt	738	10.3	Bl	777	9.7	Dl
755	11.8	B	776	12.0	Cm	774	8.9	Dl	765	7.0	Lt	746	10.6	Ht	777	10.1	Hf

Variable Star Observations Received During December, 1934.

J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.
S Aur	T Ori	AN Ori	RR Tau	SU Tau	U Ori
052034	*053005a*	*053005t*	053326	054319	054920a
778 9.0 Mc	751 10.3 Rb	749 11.4 Dh	767 11.1 Gy	779 9.5 Jo	773 6.9 Kd
779 9.5 Dl	753 10.2 Hv	753 11.7 Ko	767 11.0 Wp	780 10.0 Hf	773 6.4 Ah
780 9.6 Dl	753 9.6 Ko	753 11.5 Af	767 10.8 Wa	781 10.0 Ie	774 6.5 Dl
780 10.0 Ba	753 9.6 Af	753 11.7 Ar	773 11.0 Wp	783 9.9 Pt	774 6.9 Hf
780 9.3 Jo	753 9.5 Ar	756 11.6 Pb	773 11.0 Wa	784 10.1 Pt	774 6.4 Kg
W Aur	753 10.2 Bc	757 11.8 Pb	774 11.0 Wa	785 10.0 Pt	774 6.4 Lr
052036	754 9.8 Jo	757 11.7 Ar	774 11.0 Wp	S Col	775 6.0 Pt
770 11.8 Hi	756 9.9 Jo	757 11.6 Fr	774 10.8 Rb	*054331*	776 6.5 Dl
772 11.5 Ra	756 10.0 Hv	758 11.8 Pb	774 11.5 Wa	738∫12.6 Bl	776 7.3 Mc
775 11.1 Pt	756 9.9 Pb	758 11.7 Ar	776 11.4 Wa	746∫13.1 Ht	776 6.9 Wd
777 11.1 Hf	756 10.0 Bc	758 11.3 Dh	776 11.4 Wp	Z Tau	777 6.5 Dl
777 11.0 B	757 9.8 Hu	759 11.5 Wp	777 11.4 Wp	054615a	777 6.2 Hm
777 11.0 Sx	757 10.2 Pb	759 11.4 Wa	778 11.4 Bs	716 13.0 Bm	778 7.1 Mc
777 11.1 Wd	757 10.2 Ar	760 11.5 Wa	780 11.4 Bs	759∫13.5 Wa	778 6.4 Kg
780 10.6 Sf	757 9.9 Fr	766 11.5 Wd	780 11.4 B	RS Tau	778 7.0 Kd
780 9.7 Jo	758 10.2 Pk	766 11.3 Wa	RU Aur	054615b	779 6.5 Jo
S Ori	758 10.1 Ar	766 11.4 Wp	*053337*	759 9.3 Wa	780 6.5 Dl
052404	758 10.0 Pb	767 11.3 Wp	772 12.1 Fc	759 9.2 Wp	780 5.9 Kg
744 8.7 Sz	759 10.0 Wa	767 11.4 Wa	U Aur	RU Tau	780 6.8 Bs
749 8.7 Hu	759 10.0 Wp	770 11.7 Ra	053531	054615c	782 6.1 Bj
753 7.7 Hv	759 10.0 Hf	773 11.6 Wp	772 12.3 Fc	675 10.4 Bm	782 6.6 Rc
754 8.8 Jo	760 9.9 Wp	773 11.5 Wa	775 12.2 Pt	716 10.2 Bm	782 6.7 Sx
756 9.0 Jo	760 10.0 Wa	774 11.6 Wp	782 12.0 Ra	733 10.2 Bm	783 6.5 Dl
757 8.5 Hu	766 10.5 Wd	774 11.5 Wa	SU Tau	759 11.2 Wa	783 6.9 Kd
766 9.0 Bs	766 10.2 Wa	S Cam	054319	759 11.4 Wp	783 5.9 Hm
766 9.3 Hf	766 10.4 Wp	053068	744 9.9 Ko	R Col	783 6.7 Jo
767 9.3 Wa	767 10.4 Wp	753 9.3 Jo	745 9.8 Ko	*054629*	785 6.5 Rc
767 9.2 Wp	767 10.5 Wa	767 9.0 Jo	748 9.9 Ar	738∫13.0 Bl	786 6.3 Kg
770 9.3 Lt	770 11.1 Ra	774 9.8 Hf	748 10.1 Hf	746∫13.0 Ht	UW Ori
770 9.4 Ra	773 10.2 Wa	776 9.8 My	751 10.2 Ko	α Ori	054920b
772 9.7 Sx	773 10.5 Wp	777 9.0 Jo	751 9.7 Be	054907	773 11.1 Wp
773 9.4 Wa	774 10.5 Wp	780 8.9 Jo	753 10.0 Ar	750 0.9 Lt	V Cam
773 9.6 Wp	774 10.3 Wa	782 9.7 Ra	753 9.5 Ko	753 0.7 Si	054974
773 9.2 Hf	775 10.5 Pt	782 9.2 Hz	757 10.0 Ar	765 0.8 Lt	748 11.1 Bc
777 8.8 Jo	776 10.5 Pt	783 8.8 Jo	758 9.9 Wp	U Ori	748 11.2 Hv
777 9.3 Wd	777 10.5 Jo	RR Tau	759 10.0 Wa	054920a	750 11.5 Hv
783 9.2 Jo	777 10.3 Wd	053326	759 10.0 Wp	743 8.8 Cl	750 11.5 Bc
783 9.9 Dl	777 10.7 Bs	675 10.9 Bm	760 9.9 Wp	746 8.8 Ah	753 11.6 Bc
T Ori	777 10.2 Hf	716 12.1 Bm	760 10.0 Wa	747 8.7 Kp	753 11.5 Hv
053005a	780 10.1 Hf	727 10.9 Bm	766 9.9 Wa	748 8.7 Hf	753 12.0 Jo
743 10.0 Hu	780 10.1 Rb	733 11.2 Bm	766 10.0 Wp	749 8.2 Hu	756 12.4 Jo
743 10.1 Ar	783 10.0 Pt	743 11.9 Rb	767 9.6 Gy	751 8.0 Be	766 12.2 Bs
743 10.2 Dh	783 10.6 Jo	744 12.3 Ko	767 9.9 Wp	751 8.4 Ah	767 11.7 Gy
743 10.0 Rb	784 10.0 Pt	745 12.3 Ko	767 9.7 Wa	753 8.7 Jo	Z Aur
744 9.9 Ko	785 10.1 Pt	748 11.4 Ar	773 10.3 Wp	753 8.0 Si	055353
745 9.9 Ko	AN Ori	750 11.1 Ry	773 10.1 Wa	754 8.2 Kp	753 10.0 Jo
747 9.9 Ar	*053005t*	751 11.0 Rb	774 10.4 Wp	757 7.7 Hu	756 9.7 Jo
747 9.9 Dh	743 11.7 Hu	751 11.1 Be	774 9.9 Hf	759 7.5 Dl	758 10.1 Wp
748 10.2 Hv	743 11.1 Ar	753 11.5 Ko	774 10.2 Wa	759 7.5 Hm	760 10.3 Wp
748 10.1 Ar	743 11.1 Dh	753 11.4 Ry	775 10.0 Pt	766 6.8 Dl	760 10.1 Wa
748 10.2 Bc	744 11.5 Ko	753 11.7 Ar	776 9.9 Wd	767 7.0 Dl	767 10.0 Gy
748 10.7 Fr	747 11.7 Ar	756 10.9 Ry	776 10.1 Wa	767 6.6 Jo	767 9.7 Jo
748 10.1 Dh	747 11.7 Dh	756 10.9 Rb	776 10.3 Wp	769 6.8 Sx	772 9.6 Gy
748 10.3 Hf	748 11.7 Ar	757 11.7 Ar	776 10.3 Pt	770 6.6 Ra	774 10.1 Wa
749 10.2 Hk	748 11.5 Dh	759 10.8 Wp	777 10.0 Sf	770 6.9 Kd	774 9.9 Wp
749 10.2 Hu	748 11.6 Hf	759 10.7 Wa	777 10.4 Wp	771 7.1 Kd	775 10.4 Pt
749 10.2 Dh	749 11.5 Hk	766 10.8 Wa	777 9.8 B	773 6.8 Wa	776 10.7 Mc
751 9.6 Ko	749 11.6 Hu	766 10.9 Wp	777 10.3 Wa	773 7.0 Wp	776 10.5 Wa

VARIABLE STAR OBSERVATIONS RECEIVED DURING DECEMBER, 1934.

J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.
Z AUR	X GEM	R GEM	U CMI	X UMA	RR HYA
055353	064030	070122a	073508	083350	*094023*
776 10.3 Wp	772 12.5 Ra	776 8.5 Wd	777 9.5 Jo	756 9.4 Jo	733[13.0 Bm
778 10.9 Bs	776 12.6 Wd	777 8.6 Jo	783 9.5 Jo	773 10.5 Hf	R LEO
779 10.0 Jo	Y MON	783 8.4 Jo	783 9.0 Pt	783 10.9 Pt	094211
783 10.4 Pt	065111	783 8.2 Pt	S GEM	S HYA	746 6.8 Ah
R OCT	751 9.3 Bm	Z GEM	073723	084803	751 6.9 Ah
055686	756 9.2 Jo	070122b	751 9.5 Be	783 9.2 Pt	753 6.9 Si
738 10.5 Bl	772 10.8 Ra	748 12.4 Hf	756 9.6 Jo	783 8.3 Jo	754 6.6 Jo
746 10.7 Ht	773 9.6 Hf	772 12.3 Ra	773 9.2 Hf	T HYA	766 7.4 Hf
749 10.3 En	X MON	772 11.0 Sx	777 9.4 Jo	*085008*	771 7.0 Kd
X AUR	*065208*	774 11.7 Kg	777 9.4 Wd	777 8.0 Jo	773 8.0 Hf
060450	753 7.7 Si	776 12.4 Wd	783 9.0 Jo	783 8.2 Jo	773 7.3 Ah
744 9.9 Sz	756 7.6 Jo	TW GEM	783 9.2 Pt	783 8.0 Pt	779 7.2 Jo
751 10.0 Sq	766 8.1 Hf	070122c	W PUP	T CNC	780 8.3 Dl
753 10.4 Jo	772 9.5 Ra	748 8.5 Hf	*074241*	085120	781 8.4 Dl
766 10.2 Sq	773 8.2 Hf	753 8.2 Lt	737 8.0 dK	754 8.7 Jo	783 6.8 Pt
767 11.2 Jo	777 7.7 Jo	760 8.2 Lt	738 8.3 Bl	779 8.9 Jo	783 7.4 Jo
772 11.3 Ra	783 7.7 Jo	771 8.2 Lt	743 8.5 dK	783 9.0 Jo	Y HYA
775 11.5 Pt	R LYN	772 8.4 Ra	746 8.8 Ht	783 9.0 Pt	*094622*
TV GEM	065355	772 8.4 Sx	750 9.0 dK	S PYX	783 6.6 Pt
060521	746 7.8 Ah	773 8.5 Hf	761 9.6 dK	*090024*	Z VEL
757 6.9 Lt	756 7.5 Jo	774 8.5 Kg	767 10.4 dK	727 9.3 Bm	*094953*
768 6.9 Lt	767 7.6 Jo	776 8.4 Wd	T GEM	733 10.6 Bm	746[12.8 Ht
V MON	773 7.9 Ah	783 8.2 Pt	074323	753 11.7 Ko	V LEO
061702	774 7.9 Hf	R CMI	751 9.1 Be	V UMA	095421
782 11.5 Hz	777 7.7 Jo	070310	756 9.0 Jo	090151	757 13.6 Ar
UU AUR	782 8.2 Ra	751 9.3 Be	773 9.1 Hf	756 10.4 Jo	783[12.8 Pt
062938	783 7.6 Jo	756 9.3 Jo	777 9.1 Jo	777 10.3 Jo	RR CAR
757 5.6 Lt	RS GEM	766 9.8 Hf	777 9.0 Wd	783 10.5 Jo	*095458*
765 5.4 Lt	065530	772 8.9 Ra	783 9.0 Jo	W CNC	746 7.5 Ht
772 5.5 Lt	751 12.2 Be	773 9.4 Hf	783 8.9 Pt	090425	RV CAR
R MON	756 11.2 Jo	777 8.7 Jo	R CNC	756 9.3 Jo	*095563*
063308	779 11.3 Jo	783 8.8 Jo	081112	RW CAR	746[13.1 Ht
748 12.6 Ar	783 11.5 Jo	783 8.4 Pt	751 10.5 Be	*091868*	S CAR
753 12.1 Ko	V CMI	R VOL	772 10.6 Ra	719 9.6 Bl	*100661*
757 13.0 Ar	070109	*070772*	777 10.8 Jo	723 9.5 Bl	715 6.5 Bl
783 9.7 Jo	751 7.9 Be	746 12.4 Ht	783 11.0 Jo	746 9.4 Ht	719 5.7 Bl
NOV PIC	756 8.5 Jo	V GEM	783 10.8 Pt	Y VEL	723 5.7 Bl
063462	760 8.7 Lt	071713	V CNC	*092551*	737 5.7 dK
745 8.9 En	766 9.2 Hf	753 9.8 Jo	081617	746[12.9 Ht	743 5.8 dK
746 9.1 Ht	770 9.4 Lt	756 9.6 Jo	746 8.9 Ah	R CAR	746 5.5 Ht
749 8.9 En	772 9.3 Ra	777 8.7 Jo	751 9.0 Ah	*092962*	750 5.8 dK
S LYN	773 9.3 Hf	783 8.5 Jo	756 8.8 Jo	719 6.7 Bl	761 6.0 dK
063558	777 9.5 Jo	783 8.0 Pt	772 9.4 Ra	723 6.6 Bl	767 6.1 dK
745 9.6 Ry	783 10.6 Jo	S CMI	773 9.3 Ah	737 6.7 dK	U UMA
753 9.4 Ry	783 10.1 Pt	072708	773 9.3 Hf	743 6.6 dK	100860
756 9.1 Ry	R GEM	783 10.6 Pt	783 9.4 Pt	746 6.5 Ht	740 6.6 Hr
756 9.5 Jo	070122a	T CMI	783 9.5 Jo	750 6.6 dK	753 6.5 Hr
767 9.7 Jo	746 10.0 Ah	072811	RT HYA	761 6.1 dK	757 6.5 Lt
767 9.7 Sf	748 9.7 Hf	751 11.0 Be	*082405*	767 5.8 dK	757 6.6 Hr
772 9.7 Ra	751 8.8 Be	783 10.8 Pt	753 7.2 Ko	X HYA	767 6.5 Lt
776 9.9 My	751 9.9 Ah	Z PUP	754 7.4 Jo	*093014*	772 6.5 Lt
777 9.8 Sf	753 9.4 Jo	*072820b*	756 7.5 Jo	727 11.9 Bm	Z CAR
779 10.1 Jo	756 9.0 Jo	727 13.9 Bm	783 7.4 Pt	733 12.0 Bm	*101058a*
783 10.2 Jo	772 8.7 Ra	S VOL	R CHA	783 12.1 Pt	746[12.3 Ht
X GEM	772 9.1 Sx	*073173*	*082476*	R LMI	W VEL
064030	773 8.4 Ah	724 9.7 Bl	724[11.5 Bl	093934	*101153*
748 11.3 Hf	773 8.7 Hf	738 9.7 Bl	746 12.3 Ht	783 12.1 Pt	746 11.1 Ht
751 11.1 Be	774 8.4 Kg	746 10.3 Ht			

VARIABLE STAR OBSERVATIONS RECEIVED DURING DECEMBER, 1934.

J.D.Est.Obs. J.D.Est.Obs. J.D.Est.Obs. J.D.Est.Obs. J.D.Est.Obs. J.D.Est.Obs.

RZ CAR
103270
746[13.1 Ht
R UMA
103769
744 7.9 Sz
744 7.9 Ah
745 7.9 Ah
746 7.9 Ah
748 7.2 Hh
750 7.8 Pb
751 7.9 Ah
751 8.0 Hf
753 7.9 Jo
754 7.7 Dl
756 7.7 Dl
756 7.8 Hm
757 7.7 Pb
758 7.7 Pb
758 7.7 Hm
759 7.7 Hm
759 7.8 Dl
760 8.1 Cm
762 7.9 Ah
766 8.3 Cm
766 7.7 Dl
766 7.7 Hm
766 8.3 Hf
766 8.0 Wd
767 7.6 Hm
767 7.8 Jo
767 7.8 Dl
767 6.7 Hh
771 8.7 Mc
773 8.2 Ah
773 8.1 Dl
773 8.3 Hf
774 8.1 Dl
774 7.6 Hm
776 8.5 Mc
777 7.8 Jo
777 8.0 Dl
777 8.0 Hm
778 8.8 Bs
780 8.1 Hm
780 8.8 Ba
780 8.1 Dl
783 8.1 Dl
783 8.2 Hm
783 8.9 Pt
783 8.2 Jo
V HYA
104620
777 7.4 Jo
783 7.5 Jo
783 6.6 Pt
W LEO
104814
603[13.6 Bm
727 10.2 Bm

W LEO
104814
733 10.0 Bm
754 9.8 Jo
S LEO
110506
783 11.6 Pt
RY CAR
111561
719[12.1 Bl
RS CEN
111661
719 11.6 Bl
723 11.8 Bl
735[12.1 Bl
W CEN
115058
719 11.6 Bl
723 11.9 Bl
730[11.7 Bl
Z UMA
115158
743 8.3 Rb
744 8.3 Rb
746 8.1 Rb
747 8.3 Kp
751 8.3 Kp
751 7.7 Rb
754 7.6 Rb
754 8.2 Kp
766 7.8 Hf
773 7.3 Hf
781 7.7 Rb
SU VIR
120012
777 10.6 Jo
783 11.8 Pt
T VIR
120905
783[12.2 Pt
R CRV
121418
603 9.4 Bm
633 10.8 Bm
783 12.0 Pt
RY UMA
121561
750 7.8 Lt
SS VIR
122001
777 8.3 Jo
T CVN
122532
754 9.8 Jo
777 9.9 Jo
783 10.0 Jo
783 10.3 Pt
Y VIR
122803
603 13.0 Bm

Y VIR
122803
633 11.1 Bm
U CEN
122854
735[11.2 Bl
T UMA
123160
744 9.6 Sz
746 10.1 Ah
748 9.7 Hv
748 9.7 Bc
750 9.7 Bc
750 9.7 Hv
751 10.3 Ah
753 9.9 Hv
753 9.8 Bc
754 9.4 Jo
756 10.2 Bc
756 10.2 Hv
766 11.1 Cm
773 11.5 Ah
774 11.5 Kg
777 11.6 Jo
783 12.0 Pt
R VIR
123307
777 10.0 Jo
783 10.2 Pt
RS UMA
123459
603 9.0 Bm
633 10.3 Bm
783 13.7 Pt
S UMA
123961
744 8.7 Sz
746 8.8 Ah
748 8.7 Bc
748 8.6 Hv
750 9.0 Bc
750 8.9 Hv
751 9.1 Ah
753 8.9 Bc
753 8.9 Hv
754 9.2 Jo
756 9.3 Bc
756 9.2 Hv
766 10.4 Cm
771 9.5 Mc
772 9.9 Ra
772 10.3 Gy
773 10.3 Ah
776 9.5 Mc
777 10.0 Jo
783 10.4 Jo
783 10.5 Pt
RU VIR
124204
783 11.8 Pt

U VIR
124606
783 8.5 Pt
U OCT
131283
715 11.0 Bl
723 11.7 Bl
730 11.7 Bl
735 12.0 Bl
738 11.9 dK
745[12.4 dK
746 13.2 Ht
R HYA
132422
783 9.5 Pt
S VIR
132706
783 10.8 Pt
RV CEN
133155
715 8.0 Bl
723 7.8 Bl
730 7.8 Bl
735 8.7 Bl
T UMI
133273
766 11.6 Wd
767 11.6 Gy
T CEN
133633
719 7.4 Bl
723 7.8 Bl
RT CEN
134236
719 10.1 Bl
723 9.9 Bl
R CVN
134440
626 10.3 Pd
746 8.3 Ah
773 8.6 Ah
777 8.5 Jo
780 8.7 Jo
783 8.4 Pt
RX CEN
134536
719[12.1 Bl
T APS
134677
715 12.1 Bl
719 12.3 Bl
723 12.5 Bl
730 12.3 Bl
735 11.6 Bl
746 10.2 Ht
749 9.4 En
RR VIR
135908
783[12.8 Pt

R CEN
140959
715 10.1 Bl
718 9.9 Sl
724 10.0 Bl
730 10.0 Bl
735 10.1 Bl
737 10.1 Ht
738 10.5 dK
745 10.7 dK
750 10.6 dK
U UMI
141567
746 9.5 Ah
750 9.2 Pk
751 9.6 Hf
753 9.7 Jo
767 9.3 Pk
773 9.2 Ah
773 9.2 Hf
779 8.8 Jo
779 8.2 Md
779 8.3 Es
783 8.3 Jo
783 8.3 Pt
S BOO
141954
783 12.8 Pt
RS VIR
142205
603 13.4 Bm
633 10.5 Bm
658 9.3 Bm
689 8.4 Bm
V BOO
142539a
746 8.9 Ah
773 8.3 Ah
773 8.4 Sf
776 7.9 Mc
777 8.0 Jo
780 8.1 Jo
783 8.2 Pt
R CAM
142584
748 9.2 Hf
751 9.1 Hf
753 8.8 Jo
766 8.5 Wd
767 8.4 Gy
777 8.4 Jo
774 8.5 Hf
780 8.0 Jo
783 8.2 Jo
R BOO
143227
745 8.2 Ah
753 7.3 Si
779 7.5 Jo
783 7.6 Jo

R BOO
143227
783 7.4 Pt
Y LUP
145254
735[12.8 Bl
S APS
145971
715 12.3 Bl
718 12.5 Sl
730[12.5 Bl
735 13.0 Bl
737 13.3 Bl
746[13.2 Ht
S CRB
151731
744 8.3 Ko
744 8.2 Sz
745 8.6 Ah
746 8.7 Ah
748 8.2 Bc
748 8.3 Hv
750 8.3 Bc
750 8.3 Hv
751 8.6 Hf
753 8.5 Jo
753 8.6 Si
753 8.4 Bc
753 8.4 Hv
756 8.7 Hv
756 8.8 Dl
756 8.8 Bc
756 8.8 Jo
777 9.5 Jo
783 9.8 Pt
RS LIB
151822
715 11.2 Bl
R NOR
152849
715 7.7 Bl
730 7.7 Bl
735 7.8 Bl
W LIB
153215
719 12.5 Bl
S UMI
153378
744 12.8 Ko
748 11.6 Bc
748 11.6 Hv
750 11.6 Bc
750 11.6 Hv
753 11.6 Hv
753 11.7 Bc
756 11.8 Jo
767 11.5 Gy
775 11.2 Ra
779 10.5 Jo
780 10.9 Dl

VARIABLE STAR OBSERVATIONS RECEIVED DURING DECEMBER, 1934.

J.D.	Est.	Obs.
S UMi		
153378		
781	11.0	Dl
783	11.0	Pt
U LIB		
153620a		
719	12.9	Bl
T NOR		
153654		
737[	12.2	Ht
RR CRB		
153738		
760	8.1	Lt
771	8.2	Lt
R CRB		
154428		
720	6.2	Hr
740	6.3	Hr
743	7.1	By
743	7.1	Si
744	7.0	Hr
745	7.0	Ah
745	7.0	Hr
746	7.0	Ah
746	7.3	Hr
747	7.4	Si
747	7.1	Ar
747	7.1	Dh
747	7.0	Af
748	7.5	Hg
748	7.2	Lf
748	6.8	Pk
748	7.3	Hv
748	7.5	Si
748	7.2	Dh
748	7.2	Ar
748	7.3	Bc
748	7.1	Af
748	7.7	Fr
749	7.5	Si
749	7.6	Ar
749	7.5	Dh
749	7.6	Hr
749	7.5	Hu
749	7.3	Bc
749	7.3	Hv
749	7.4	Hc
750	7.5	Hv
750	7.8	Hr
750	7.4	Pk
750	7.5	Hf
751	7.7	Af
751	7.8	Hf
751	8.1	Hr
752	7.7	Si
752	8.0	Bc
752	7.6	Pk
752	8.6	Hr
753	8.0	Si
753	8.2	Af

J.D.	Est.	Obs.
R CRB		
154428		
753	8.0	Hv
753	8.0	Jo
753	7.7	Cm
753	8.0	Bc
753	7.6	Kd
754	8.0	Dl
754	8.1	Jo
754	8.4	Si
754	8.0	Pb
756	8.4	Jo
756	8.4	Dl
756	8.4	Hf
756	8.6	Rb
756	8.4	Wd
756	8.0	Bc
756	8.2	Pb
756	8.5	Hv
757	8.4	Sx
757	8.2	Ar
757	8.7	Jo
757	8.2	Fn
757	8.6	Rb
758	8.2	Hm
758	8.2	Fr
758	8.4	Dl
758	8.1	Hk
758	8.7	Rb
758	8.2	Pb
760	8.4	Wd
760	8.1	Cm
760	8.4	Hf
761	8.7	Rb
766	8.5	Dl
766	8.8	Rb
767	8.8	Gy
767	8.6	Jo
767	8.5	Ba
767	8.5	Cm
771	9.4	Kd
772	9.1	Gy
773	9.4	Si
774	9.3	Cm
774	9.0	Rb
776	9.5	Si
777	9.0	Jo
779	9.6	Dl
780	9.2	Rb
782	9.6	Si
783	10.0	Si
783	9.8	Pt
784	10.4	Si
X CRB		
154536		
753	9.6	Jo
756	9.5	Jo
767	9.4	Jo
783	9.7	Pt

J.D.	Est.	Obs.
R SER		
154615		
753	6.7	Jo
756	6.8	Jo
783	7.1	Pt
V CRB		
154639		
750	8.6	Hf
753	7.5	Jo
756	7.4	Jo
760	7.9	Cm
767	8.8	Cm
767	7.7	Jo
777	7.8	Jo
781	8.7	Cm
783	8.1	Pt
T CRB		
155526		
783	10.0	Pt
RZ Sco		
155823		
737	10.6	Ht
Z Sco		
160021		
715	10.8	Bl
737	10.9	Bl
U SER		
160210		
783	9.0	Pt
X Sco		
160221a		
715	11.2	Bl
737	11.3	Bl
SX HER		
160325		
744	8.2	Ko
745	8.0	Ko
750	8.2	Hf
751	8.0	Ko
767	8.2	Jo
783	8.1	Pt
W Sco		
160519		
716[	12.6	Bl
737[	11.8	Bl
RU HER		
160625		
714	13.9	Pd
783[	12.4	Pt
R Sco		
161122a		
603	14.0	Bm
633	12.2	Bm
658	11.2	Bm
674	11.1	Bm
685	11.4	Bm
689	11.5	Bm
703	12.2	Bm
737[	12.8	Bl

J.D.	Est.	Obs.
S Sco		
161122b		
603	11.4	Bm
633	13.9	Bm
674[	12.5	Bm
689[	13.6	Bm
703	13.3	Bm
716	12.4	Bl
729	12.0	Bm
737	11.6	Bl
W CRB		
161138		
744	8.5	Sz
750	8.6	Hf
753	8.7	Jo
767	9.2	Jo
767	9.8	Cm
777	10.6	Jo
781	10.5	Cm
783	11.0	Pt
U HER		
162119		
756[	11.5	Pb
783[	12.0	Pt
Y Sco		
162319		
716[	11.8	Pd
g HER		
162542		
747	4.8	Lt
T OPH		
162815		
719[	12.0	Bl
737[	12.0	Bl
S OPH		
162816		
719	11.3	Bl
737	9.7	Bl
W HER		
163137		
743	10.4	Fr
744	10.4	Fr
744	11.1	Ko
744	10.9	Sz
749	10.7	Hu
751	11.5	Rb
753	11.5	Jo
756	11.6	Rb
757	11.5	Fr
766	11.9	Rb
775	13.0	Pt
R UMi		
163172		
744	9.5	Bc
744	9.5	Hv
748	9.7	Hv
748	9.8	Bc
750	9.7	Bc
750	9.7	Hv
751	9.9	Hf

J.D.	Est.	Obs.
R UMi		
163172		
753	9.7	Hr
753	9.7	Bc
753	9.5	Sq
753	9.6	Jo
756	9.6	Hv
756	9.6	Bc
756	10.0	Wd
766	9.9	Wd
774	9.9	Hf
775	9.5	Ra
777	9.2	Jo
780	9.4	Jo
783	9.9	Wd
R DRA		
163266		
714	11.2	Pd
746	9.3	Ah
747	9.4	Pk
751	9.0	Ah
751	9.3	Hf
753	8.8	Bc
753	9.0	Fs
753	8.8	Hv
753	9.1	Jo
753	8.6	Si
754	9.2	Kp
756	8.3	Hv
756	8.4	Bc
756	8.7	Wd
758	8.6	Lu
766	8.5	Wd
767	8.6	Gy
767	8.3	Lu
767	8.2	Fs
767	8.7	Dl
773	8.2	Dl
774	8.4	Dl
774	8.1	Hf
775	8.2	Pt
777	7.7	Jo
777	8.4	Dl
780	8.2	Dl
780	7.8	Jo
781	8.1	Dl
783	8.0	Dl
783	7.9	Wd
RR OPH		
164319		
603	13.2	Bm
658	9.4	Bm
674	8.6	Bm
703	9.5	Bm
729	10.4	Bm
S HER		
164715		
744	8.2	Ah
746	8.3	Ah
750	7.9	Hf

J.D.	Est.	Obs.
S HER		
164715		
753	7.8	Jo
756	7.6	Jo
756	8.4	Dl
766	8.4	Dl
767	7.7	Jo
774	8.0	Cm
RS Sco		
164844		
716	7.6	Bl
730	6.3	Bl
735	6.5	Bl
737	6.7	Ht
738	6.5	dK
745	6.3	dK
745	6.5	En
746	6.6	Ht
751	6.3	dK
755	6.5	Ht
RR Sco		
165030a		
716	11.7	Bl
735	11.2	Bl
737	11.7	Ht
739	11.5	dK
745	11.3	dK
746	11.3	Ht
RV HER		
165631		
766[	13.5	Pf
775[	13.4	Pt
RT Sco		
165636		
716[	13.0	Bl
735[	13.0	Bl
RT HER		
170627		
716	14.9	Pd
751	10.6	Ko
766	10.2	Pf
775	9.6	Pt
RW Sco		
170833		
719[	12.6	Bl
735[	12.5	Bl
Z OPH		
171401		
767	12.2	Cm
RS HER		
171723		
714	12.4	Pd
747	11.5	Hi
751	11.0	Rb
756	11.0	Rb
766	11.3	Rb
767	10.7	Jo
775	10.5	Pt
779	10.7	Jo
783	10.8	Jo

VARIABLE STAR OBSERVATIONS RECEIVED DURING DECEMBER, 1934.

J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.
S OCT	V DRA	W LYR	X OPH	R SCT	R SCT
172486	175654	181136	183308	*184205*	*184205*
719 12.7 Bl	772 10.8 Gy	756 7.7 Jo	765 8.0 Si	749 5.5 Af	765 5.7 Si
730 12.4 Bl	775 10.8 Pt	756 7.7 Wd	768 8.0 Hz	749 5.3 Bc	766 5.4 Hm
736 11.8 Bl	R PAV	757 8.0 Je	769 7.8 Rc	749 5.3 Hu	766 5.9 Dl
746 10.6 Ht	*180363*	758 8.0 Cm	777 8.0 Jo	749 5.2 Hv	766 5.9 Rb
749 10.3 En	737 8.5 Ht	760 8.1 Cm	780 8.0 Jo	750 5.4 Hf	767 5.6 Rb
751 10.4 dK	738 8.4 dK	760 7.9 Kp	780 7.7 Bj	750 5.2 Bc	767 5.5 Lu
757 10.0 dK	745 8.3 dK	762 7.9 Ah	782 7.7 Rc	750 5.5 Hr	767 5.9 Dl
764 9.9 dK	745 8.4 En	762 8.2 Md	783 7.8 Jo	750 5.2 Hv	767 6.0 Gy
RU OPH	746 8.4 Ht	765 8.0 Sx	RY LYR	750 5.5 Pb	767 5.9 Hm
172809	751 8.1 dK	765 7.8 Wh	184134	751 5.3 Lu	767 5.8 Jo
752 11.8 Fc	755 8.2 Ht	765 7.7 Pk	747 10.0 Pf	751 5.8 Kp	767 5.6 Kg
RU SCO	757 8.1 dK	766 8.3 Cm	747 10.1 Fc	751 5.3 Hv	767 5.3 Ba
173543	764 8.0 dK	766 7.9 Wd	749 9.8 Hu	751 5.3 Ko	768 5.7 Hz
716 9.7 Bl	T HER	767 7.8 Sf	751 10.3 Ko	751 5.5 Af	769 5.9 Rc
736 8.9 Bl	180531	767 8.7 Je	751 10.4 Hf	751 5.4 Fr	769 5.8 Kd
745 9.1 En	715 10.5 Pd	768 8.0 Ra	753 9.2 Jo	751 5.6 Hr	771 5.9 Kd
SV SCO	746 13.1 Ks	769 7.7 Pk	756 9.3 Jo	751 5.5 Hr	772 6.0 Ra
174135	747 13.4 Fc	772 8.8 Je	770 11.4 Fc	751 5.6 Rb	772 6.0 Gy
716 10.9 Bl	772 11.8 Ra	773 8.5 Ah	775 11.9 Pt	752 5.1 Bc	773 5.5 Pt
736 10.2 Bl	772 12.4 Gy	774 8.4 Hf	777 9.5 Jo	752 5.7 Ar	774 5.8 Cm
745 9.9 En	775 12.2 Pt	774 8.5 Lr	780 9.7 Jo	753 5.5 Si	774 5.6 Hf
W PAV	780 11.7 Ba	774 8.3 Kg	R SCT	753 5.0 Jo	774 5.5 Bc
174162	783 11.5 Jo	775 8.2 Pt	*184205*	753 5.3 Bc	774 5.8 Pt
716 11.8 Bl	W DRA	777 8.2 Jo	714 5.5 Pd	753 5.3 Hv	774 6.1 Hm
736 12.8 Bl	180565	777 8.5 Wd	718 5.5 Sl	753 5.4 Pb	774 5.6 Kg
745 13.0 En	747 12.0 Pf	777 8.6 Sf	740 5.3 Hr	754 5.4 Dl	774 5.9 Rb
755 13.0 Ht	751 11.8 Ko	780 8.8 Jo	743 5.3 By	754 5.4 Hv	775 6.0 Rc
RS OPH	775 12.2 Pt	781 8.5 Cm	743 5.4 Fr	754 5.3 Hm	776 5.5 Mc
174406	X DRA	783 9.0 Jo	743 5.4 Af	754 5.7 Rb	777 6.1 Hm
743 11.1 Hi	180666	783 8.8 Wd	743 5.3 Lu	755 5.8 Kd	777 5.9 Kd
744 11.1 Hi	715 10.8 Pd	RV SGR	743 5.4 Hv	755 5.6 Hr	777 5.8 Jo
745 11.3 Ko	747 12.5 Pf	*182133*	743 5.7 Rb	756 5.0 Jo	778 5.4 Mc
747 11.4 Hi	751 10.6 Ko	716 8.5 Bl	743 5.5 Si	756 5.2 Hm	779 5.7 Jo
756 11.1 Rb	NOV OPH	736 7.6 Bl	744 5.4 Fr	756 5.7 Bc	780 6.0 Gy
U ARA	180911	745 7.3 En	744 5.4 Hv	756 5.7 Hv	780 5.7 Kg
174551	747 13.4 Ar	SV HER	744 5.4 Af	756 5.4 Pb	780 6.0 Dl
737 12.4 Ht	748 13.4 Ar	182224	744 5.5 Rb	756 5.5 Dl	780 6.2 Hm
745 12.3 En	752 13.3 Ar	751 10.7 Ko	745 5.6 Rb	756 5.8 Rb	780 5.5 Ba
746 12.8 Ht	RY OPH	752 10.7 B	745 5.1 Ko	757 5.5 Hv	780 5.6 Jo
RT OPH	181103	756 10.7 Jo	745 6.1 Ah	757 5.4 Fr	781 6.0 Dl
175111	743 8.5 Cl	766 11.2 B	745 5.2 Hr	757 5.6 Rb	781 5.9 Rb
752 10.7 Fc	750 8.6 Hf	SV DRA	746 6.0 Ah	757 6.0 Ra	781 6.0 Hm
767 11.0 Jo	752 8.6 Fc	183149	746 5.5 Rb	758 5.8 Rb	782 5.9 Rc
T DRA	753 8.3 Jo	751 12.8 Ko	747 5.6 Rb	758 5.6 Hv	783 6.0 Dl
175458a	756 8.8 Jo	RZ HER	747 5.3 Hv	758 5.3 Lu	783 6.0 Hm
715 10.6 Pd	767 9.2 Jo	183225	747 5.7 Kp	758 5.4 Pb	783 5.5 Jo
UY DRA	779 10.5 Jo	751 10.5 Ko	747 5.5 Af	758 5.6 Fr	785 5.9 Rc
175458b	W LYR	766 10.7 Pf	747 5.5 Ar	758 5.5 Dl	RW LYR
715 10.7 Pd	181136	X OPH	747 5.5 Dh	758 5.4 Hm	184243
RY HER	744 7.9 Ah	183308	748 5.4 Fr	759 5.6 Kg	717 14.2 Pd
175519	745 7.9 Ah	601 8.4 Pd	748 5.5 Ar	760 5.6 Kg	747 15.4 Ar
753 9.7 Jo	747 7.7 Pk	745 8.0 Ko	748 5.4 Af	760 5.7 Kp	748 15.3 Ar
756 10.4 Jo	747 7.6 Kp	747 8.6 Kp	748 5.1 Hv	760 5.2 Lu	752 15.2 Ar
767 11.4 Jo	751 7.7 Ko	750 8.3 Hf	748 5.1 Bc	760 5.9 Dl	NOV AQL
775 11.7 Pt	751 7.7 Hf	753 8.2 Jo	748 5.8 Rb	760 5.3 Hm	184300
V DRA	753 7.9 Jo	753 8.0 Si	748 5.5 Dh	760 5.6 Rb	743 10.8 Af
175654	754 7.6 Kp	760 8.6 Kp	748 5.5 Lf	761 5.6 Rb	743 10.8 Fr
753 10.2 Jo	755 7.8 Je	765 8.2 Sx	749 5.5 Dh	765 5.8 Sx	744 11.0 Fr

Variable Star Observations Received During December, 1934.

J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.
Nov Aql	R CrA	RW Sgr	W Aql	S Sgr	RT Aql
184300	*185537a*	*190819a*	*191007*	*191319a*	193311
744 11.0 Af	746 11.0 Ht	755 10.3 Ht	752 9.1 Fc	755 12.2 Ht	746 13.5 Ks
746 10.9 Ks	755 10.9 Ht	757 9.9 Fc	757 8.9 Fc	757 12.0 Fc	752 13.9 Fc
747 10.9 Ar	T CrA	TY Aql	781 8.0 Bj	771 11.0 Fc	R Cyg
747 10.8 Af	*185537b*	*190907*	T Sgr	Z Sgr	193449
748 10.8 Af	716 13.0 Bl	651 10.6 Fc	*191017*	*191321*	642 12.3 Fc
748 10.9 Ar	736 13.0 Bl	663 10.7 Fc	635 11.1 Fc	663[13.3 Fc	647 12.5 Fc
748 11.3 Bc	746 12.6 Ht	741 10.8 Bj	637 10.8 Fc	745 10.9 En	652 12.4 Fc
748 11.3 Hv	755[12.5 Ht	747 10.8 Ar	652 11.5 Fc	SW Sgr	670 12.9 Fc
750 11.4 Hv	Z Lyr	748 10.8 Ar	715 12.5 Pd	*191331*	715 13.3 Pd
750 11.4 Bc	185634	752 11.2 Ar	746 12.5 Ks	719[12.9 Bl	746 13.5 Ks
750 10.9 Pb	747 12.9 Fc	752 10.9 Fc	757 12.6 Fc	745[12.1 En	748 13.4 Hf
751 10.9 Af	775 13.5 Pt	757 10.7 Fc	771 11.8 Fc	TZ Cyg	756 13.0 Wd
751 10.8 Fr	SU Sgr	781 11.0 Bj	R Sgr	191350	766 13.0 Bs
752 10.6 Fc	*185722*	S Lyr	*191019*	652 11.2 Fc	767 12.6 Pk
752 10.9 Ar	746 8.4 Ht	190925	715 10.0 Pd	670 11.4 Fc	772 12.5 Gy
753 11.5 Bc	755 8.4 Ht	643 12.2 Fc	741 9.8 Bj	713 10.2 Fc	773 12.5 B
753 11.4 Hv	RT Lyr	647 12.1 Fc	745 9.2 En	747 10.9 Ar	776 12.8 Pt
753 10.8 Pb	185737	650 12.6 Fc	746 8.7 Ht	747 10.6 Fc	777 12.3 Hf
753 11.2 Jo	747 10.4 Pf	710 13.2 Fc	748 8.7 Cl	748 11.0 Ar	777 12.3 Wd
756 11.1 Pb	747 10.6 Fc	757[13.5 Fc	755 8.5 Ht	753 11.1 Ar	780 12.9 Es
757 11.1 Fr	751 11.2 Ko	775[12.5 Pt	757 8.2 Fc	767 10.6 Jo	781 12.0 Cm
767 11.2 Jo	753 11.0 Wu	X Lyr	771 8.5 Fc	772 10.2 Ra	783 12.0 Wd
767 10.8 Gy	757 10.7 Fc	190926	RY Sgr	775 10.8 Pt	RV Aql
769 10.4 Rc	R Aql	775 8.9 Pt	*191033*	777 10.4 Jo	193509
770 10.8 Fc	190108	RS Lyr	715 7.5 Bl	783 10.0 Jo	642[13.3 Fc
772 10.6 Gy	746 11.6 Ah	190933a	719 7.7 Bl	U Lyr	651[13.3 Fc
774 11.4 Pt	752 10.9 Fc	635 10.8 Fc	719 7.2 Sl	191637	745 9.7 Ko
S Sct	753 11.5 Jo	643 10.7 Fc	724 7.9 Bl	643 11.2 Fc	747 9.9 Ar
184408	766 10.6 B	647 10.5 Fc	730 8.1 Bl	647 11.1 Fc	748 9.7 Ar
750 7.3 Lt	773 9.5 Hz	650 10.5 Fc	736 8.0 Bl	650 11.0 Fc	748 9.4 Wu
RX Lyr	774 10.3 Rb	659 10.7 Fc	737 7.9 Bl	659 11.6 Fc	752 9.8 Ar
185032	775 9.6 Pt	717 13.7 Pd	737 7.9 Ht	747 12.0 Fc	752 9.4 Fc
747 12.6 Ar	777 10.8 Jo	775[12.5 Pt	738 8.0 En	757 11.9 Fc	776 9.8 Pt
747 12.3 Pf	780 10.5 Jo	RU Lyr	738 7.9 dK	768 11.9 Ra	TT Cyg
748 12.9 Ar	780 9.5 Rb	190941	745 7.6 dK	770 12.0 Fc	193732
752 12.9 Ar	783 10.3 Jo	635 14.5 Fc	745 7.2 En	775 12.0 Pt	757 8.2 Lt
753 12.9 Ar	V Lyr	647[13.3 Fc	746 7.5 Ht	AF Cyg	766 8.2 Lt
756 12.2 Pb	190329a	710 12.4 Fc	751 7.7 dK	192745	T Pav
757 12.2 Fr	666 9.0 Fc	717[14.0 Pd	755 7.6 Ht	746 7.1 Ah	*193072*
775[13.0 Pt	710 9.9 Fc	747 14.5 Pf	757 7.6 dK	751 7.4 Ah	719 8.3 Bl
776 11.5 Pd	712 10.2 Fc	775[12.3 Pt	764 7.9 dK	762 7.1 Ah	736 8.8 Bl
S CrA	745 11.5 Ko	U Dra	TY Sgr	768 7.0 Ra	738 8.5 dK
185437a	747 11.8 Fc	190967	*191124*	770 7.6 Kd	745 8.8 dK
716 12.5 Bl	757 11.8 Fc	715 13.9 Pd	635 12.8 Fc	771 7.6 Kd	745 8.8 En
718 11.7 Sl	770 12.0 Fc	747 13.5 Pf	649 11.3 Fc	773 7.1 Ah	746 9.0 Ht
736 11.7 Bl	775 13.1 Pt	747 13.0 Wu	652 10.8 Fc	783 7.7 Kd	751 8.8 dK
745 11.7 En	RX Sgr	753 11.8 Jo	663 10.3 Fc	TY Cyg	755 9.3 Ht
746 11.6 Ht	*190818*	770 12.0 Fc	716 10.5 Bl	192928	757 9.3 dK
755 12.1 Ht	663[13.5 Fc	772 11.9 Gy	736 11.1 Bl	650[13.0 Fc	764 9.5 dK
ST Sgr	745 10.6 En	775 12.1 Pt	745 11.7 En	717[13.8 Pd	RT Cyg
185512a	746 10.5 Ht	780 11.9 Es	771[12.1 Fc	772 11.9 Gy	194048
716[12.6 Pd	755 10.5 Ht	W Aql	S Sgr	775 11.6 Pt	745 11.2 Ko
R CrA	757 10.5 Fc	*191007*	*191319a*	RT Aql	746 11.2 Ah
185537a	RW Sgr	663 12.5 Fc	663[14.0 Fc	193311	746 10.0 Ks
716 12.0 Bl	*190819a*	741 9.7 Bj	716[12.2 Bl	649 12.2 Fc	747 11.8 Pk
718 12.5 Sl	663 9.9 Fc	747 9.6 Ar	737 12.4 Bl	651 13.1 Fc	748 11.7 Hf
736 12.3 Bl	745 10.6 En	748 9.5 Ar	745 12.2 En	663 13.4 Fc	754 11.9 Wa
745 11.4 En	746 10.5 Ht	752 9.2 Ar	746 12.6 Ht	715 14.4 Pd	756 11.8 Wd

VARIABLE STAR OBSERVATIONS RECEIVED DURING DECEMBER, 1934.

J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.
RT CYG			χ CYG			RU SGR			S CYG			Z AQL			RS CYG		
194048			194632			*195142*			200357			*200906*			200938		
760	12.1	Wa	761	9.3	B	757	7.9	dK	642	11.4	Fc	658	11.6	Bm	766	8.7	Sx
760	12.2	Wp	765	9.5	B	764	8.2	dK	652	11.0	Fc	674	9.2	Bm	767	7.2	Je
765	12.0	Pk	766	9.2	Rb	RR AQL			670	11.3	Fc	685	9.0	Bm	767	8.2	Lu
766	12.2	B	766	9.2	Wd	*195202*			712[	12.3	Fc	689	9.4	Bm	767	7.5	Jo
766	12.0	Wd	766	9.5	Wp	642	12.1	Fc	752[	13.5	B	703	10.1	Bm	770	8.6	Hf
767	12.2	Jo	766	9.4	Wa	649	12.2	Fc	776[	12.4	Pt	710	11.2	Bm	771	7.5	Be
768	12.0	Ra	767	9.4	Wa	651	12.2	Fc	R CAP			729	11.6	Bm	772	7.3	Je
773	12.5	Hz	767	9.5	Wp	663	12.3	Fc	*200514*			742	13.0	Bm	772	8.7	Sx
774	12.2	Cm	767	8.9	Jo	668	12.8	Fc	663	11.6	Fc	776	12.2	Bj	772	8.5	Ra
776	11.8	Pt	767	9.2	Lu	752[	13.1	Fc	S AQL			R SGE			773	8.2	Hz
777	12.5	Hf	767	9.5	Je	RS AQL			200715a			200916			774	8.6	Cm
777	12.0	Jo	767	9.4	Gy	*195308*			637	11.0	Fc	753	9.2	Jo	774	8.3	Lr
777	12.5	Wd	770	9.4	Kd	642[	13.8	Fc	642	11.2	Fc	777	9.4	Jo	774	8.7	Hf
781	12.6	Cm	771	9.3	Kd	651[	13.1	Fc	649	11.0	Fc	RS CYG			774	8.0	Kg
783	11.8	Jo	772	9.3	Je	752	13.0	Fc	651	11.4	Fc	200938			776	7.2	Pt
783	12.0	Wd	772	9.0	Sx	777	11.4	Jo	663	10.7	Fc	670	7.2	Fc	777	7.7	Jo
TU CYG			772	9.4	Gy	781	10.4	Bj	668	10.6	Fc	743	7.9	Af	780	7.8	Bj
194348			773	9.1	Hz	NOV CYG			713	9.6	Fc	743	7.9	Fr	780	8.6	Sh
642	9.7	Fc	774	9.2	Hf	195553			749	10.0	Hu	743	7.9	Lu	780	8.3	Kg
647	9.9	Fc	774	9.1	Rb	652	14.0	Fc	751	9.5	Hf	744	8.0	Af	782	8.9	Rc
652	10.3	Fc	774	9.3	Wa	670[	13.2	Fc	752	9.5	Fc	744	8.0	Fr	783	7.9	Jo
670	11.0	Fc	774	9.5	Wp	747	14.5	Ar	753	9.4	Jo	744	7.3	Ko	785	9.0	Rc
748	12.8	Hf	776	8.3	Pt	748	14.4	Ar	766	9.8	B	747	8.3	Ar	R DEL		
776	13.0	Pt	776	8.9	Sx	753	14.4	Ar	771	9.6	Fc	748	7.7	Ar	201008		
X AQL			776	9.4	Wa	774[	12.2	Pt	776	9.7	Pt	748	7.9	Af	642	12.9	Fc
194604			776	9.4	Wp	RR TEL			777	10.4	Jo	748	7.4	Bc	668	13.6	Fc
642	9.0	Fc	777	9.4	Wp	*195656*			RW AQL			748	7.9	Fr	751	9.3	Hf
649	9.2	Fc	777	9.4	Wa	746[	12.9	Ht	200715b			748	7.3	Hv	753	9.0	Jo
651	9.2	Fc	777	8.7	Jo	Z CYG			668	9.2	Fc	748	7.5	Sq	758	8.8	B
663	10.1	Fc	779	8.8	Jo	195849			713	9.1	Fc	748	8.4	Hf	761	8.8	B
668	10.0	Fc	780	8.9	Hf	642	8.7	Fc	749	9.2	Hu	750	7.3	Bc	767	8.6	Jo
752	14.2	Fc	780	8.8	Jo	652	8.4	Fc	752	9.3	Fc	750	7.4	Hv	767	8.3	Sf
χ CYG			780	9.1	Rb	670	8.3	Fc	753	9.4	Jo	750	7.7	Pb	768	9.5	Ra
194632			780	8.3	Bj	710	9.0	Fc	766	9.3	B	751	7.9	Af	768	8.5	Lt
715	11.5	Pd	780	9.4	Kd	712	9.6	Fc	771	9.2	Fc	751	7.9	Fr	771	8.1	Be
743	9.7	Rb	781	8.8	Cm	745	10.9	Ko	776	8.9	Pt	751	8.0	Lu	772	8.3	Bj
743	9.6	Lu	783	8.7	Jo	747	11.3	Fc	777	9.3	Jo	753	8.0	Ar	774	8.1	Hf
744	9.6	Ko	783	9.0	Wd	770	12.5	Ra	R TEL			753	7.2	Bc	776	8.2	Pt
747	9.6	Kp	783	9.4	Kd	773	12.6	Hz	*200747*			753	7.2	Hv	777	8.8	Jo
748	9.7	Sq	S PAV			776	12.6	Pt	720	13.8	Bl	753	7.9	Pb	777	8.3	Sf
748	9.7	Hf	*194659*			S TEL			747	12.6	En	753	7.4	Jo	780	8.8	Jo
751	9.7	Lu	745	7.5	En	*195855*			RU AQL			753	7.7	Si	783	8.7	Jo
751	9.7	Rb	RR SGR			720	13.1	Bl	200812			755	7.1	Je	RT CAP		
753	9.7	Jo	*194929*			746	12.9	Ht	642	9.8	Fc	756	7.3	Bc	*201121*		
753	9.6	Si	719	8.4	Bl	SY AQL			649	9.8	Fc	756	7.3	Hv	771	7.5	Kd
755	9.7	Je	736	7.7	Bl	200212			651	10.1	Fc	756	8.0	Pb	SX CYG		
756	9.5	Rb	745	8.0	En	642	12.9	Fc	663	10.8	Fc	757	8.0	Fr	201130		
756	9.2	Wd	771	10.2	Fc	649	12.0	Fc	668	11.2	Fc	757	7.2	Je	650	9.9	Fc
756	9.5	Wa	RU SGR			651	12.1	Fc	752	11.2	B	757	7.9	Pb	670	10.1	Fc
756	9.5	Wp	*195142*			663	10.6	Fc	761	12.1	B	758	7.7	Fr	773	13.8	B
758	9.4	Lu	720	7.1	Bl	668	9.5	Fc	W CAP			758	7.3	Hv	RT SGR		
759	9.5	Wa	738	7.6	Bl	710	9.2	Fc	*200822*			758	8.3	Lu	*201139*		
759	9.5	Wp	738	7.3	dK	713	8.6	Fc	738[	12.8	Bl	758	8.7	Cm	720	7.0	Bl
760	9.5	Wp	745	7.3	dK	752	10.5	Fc	Z AQL			760	8.2	Lu	738	7.1	Bl
760	9.4	Wa	745	7.9	En	767	10.8	Sf	*200906*			760	8.0	Cm	WX CYG		
760	9.1	Cm	746	7.3	Ht	772	11.0	B	642	11.9	Fc	760	7.9	Kg	201437b		
760	9.3	Lu	751	7.5	dK	776	11.4	Pt	649	11.5	Fc	765	7.5	Wh	743	10.6	Rb
760	9.3	Kp	755	7.7	Ht				651	11.2	Fc	766	8.6	Wd	744	9.0	Ko

Variable Star Observations Received During December, 1934.

J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.
WX Cyg	U Cyg	RU Cap	S Del	V Aqr	S Ind
204137b	201647	*202622*	203816	204102	*204954*
747 9.7 Ar	748 7.1 Hv	685 14.6 Bm	642 9.5 Fc	751 8.7 Hf	738 10.8 Bl
748 9.8 Ar	748 7.1 Bc	689 14.6 Bm	649 9.1 Fc	753 8.9 Jo	746 10.4 Ht
748 9.2 Sq	748 7.3 Sq	710 13.6 Bm	651 9.2 Fc	753 8.7 Es	747 10.0 En
748 9.7 Hf	750 7.2 Bc	729 10.2 Bm	668 10.6 Fc	761 8.7 B	755 9.6 Ht
750 9.5 Pk	750 7.2 Hv	742 9.7 Bm	744 11.5 Sz	775 8.2 Pt	X Del
751 9.9 Rb	750 7.8 By	747 9.3 En	766 10.8 B	778 9.3 Md	205017
753 9.5 Jo	751 7.4 Hv	761 9.3 B	771 10.9 Be	W Aqr	642 14.5 Fc
753 9.8 Ar	751 7.6 Kp	Z Del	775 10.1 Pt	*204104*	651 14.0 Fc
756 10.6 Rb	751 7.7 Lu	202817	777 12.0 Jo	658 9.4 Bm	749 9.0 Hu
758 10.4 Lu	751 7.5 Ah	642 11.4 Fc	V Cyg	685 9.9 Bm	752 8.9 Hk
760 9.8 Lu	751 7.9 Hf	651 11.0 Fc	203847	689 10.2 Bm	753 8.6 Jo
760 10.1 Cm	753 7.0 Bc	668 10.1 Fc	652 11.4 Fc	703 11.0 Bm	754 8.9 Pb
766 9.0 B	753 7.6 Fs	743 9.8 Af	670 12.1 Fc	729 11.9 Bm	756 8.9 Pb
766 9.7 Wd	753 7.1 Hv	743 9.8 Fr	746 12.9 Ks	742 13.2 Bm	756 8.9 Fr
766 10.6 Rb	753 7.7 Si	744 9.8 Fr	773 13.8 B	766 13.1 Hi	757 8.9 Fr
767 9.8 Lu	754 7.7 Kp	744 9.7 Af	775 13.3 Pt	771[12.4 Fc	758 8.9 Fr
767 9.3 Jo	755 7.6 Je	747 10.0 Ar	Y Aqr	U Cap	758 8.8 B
771 9.4 Be	756 7.1 Bc	747 10.1 Hi	*203905*	*204215*	766 9.1 B
772 9.4 Ra	756 7.1 Hv	748 10.0 Ar	658[14.5 Bm	724[14.0 Pd	771 9.0 Be
773 9.1 Hz	758 7.7 Lu	748 10.0 Af	689[14.7 Bm	738 13.5 Bl	771 9.5 Fc
774 10.6 Cm	758 8.1 Cm	748 10.0 Fr	717[13.9 Pd	772 11.2 B	780 9.9 Md
774 9.5 Hf	758 7.3 Hv	750 9.9 Pb	729[14.3 Bm	V Del	780 9.8 Es
774 9.3 Kg	760 7.7 Kp	753 10.1 Ar	742 14.6 Bm	204318	RR Cap
774 10.6 Rb	760 7.7 Lu	753 10.0 Af	775 12.2 Pt	642[13.9 Fc	*205627*
774 9.4 Lr	760 7.6 Kg	753 10.2 Es	776 12.1 Bj	651[13.1 Fc	747 10.0 En
777 9.5 Jo	765 7.4 Pk	754 10.0 Pb	T Del	717[14.6 Pd	R Vul
778 10.9 Md	766 7.3 B	756 10.0 Pb	204016	752[13.1 Hk	205923a
779 10.7 Bs	766 7.7 Sx	756 10.0 Fr	642 12.3 Fc	766 13.3 B	635 12.2 Fc
780 10.7 Rb	766 7.8 Wd	757 10.1 Fr	650 12.1 Fc	772 12.7 Gy	636 12.2 Fc
780 9.1 Bj	767 7.8 Fs	758 10.2 Fr	651 12.2 Fc	777 11.9 Wp	651 10.9 Fc
780 9.4 Jo	767 7.1 Hh	761 10.3 B	743 9.7 Af	777 11.8 Wa	652 10.6 Fc
783 9.5 Jo	767 7.6 Je	766 10.9 Hi	743 9.8 Fr	T Aqr	752 12.4 Es
V Sge	767 7.6 Lu	771 11.2 Be	744 9.7 Fr	*204405*	767 12.5 Jo
201520	767 7.6 Sf	776 11.9 Pt	744 9.6 Af	760 11.2 Cm	776 12.5 Pt
745 12.6 Hr	767 7.4 Jo	780 11.9 Es	747 9.7 Af	766 11.1 Cm	779 12.4 Bs
747 12.0 Ar	768 7.5 Ra	780 11.9 Md	748 9.5 Af	766 10.7 B	779 12.3 Jo
748 12.7 Ar	769 6.9 Pk	ST Cyg	748 9.8 Fr	769 10.5 Pk	V Cap
750 11.9 Ar	769 7.5 Md	202954	749 10.0 Hu	772 10.2 Ra	*210124*
751 12.7 Rb	771 8.5 Mc	652 13.2 Fc	751 9.6 Af	774 10.0 Cm	720 10.4 Bl
753 11.9 Ar	771 6.8 Bj	670 13.6 Fc	751 9.7 Fr	775 9.8 Pt	738 11.5 Bl
766 12.4 Rb	772 7.6 Je	752 10.5 B	752 10.2 Hk	776 10.2 Bj	747 11.7 En
767 12.6 Gy	773 7.5 Ah	761 11.0 B	753 9.7 Pb	779 10.0 Bs	TW Cyg
774 12.7 Rb	773 7.8 Hz	771 10.4 Fc	753 9.7 Af	780 9.7 Kg	210129
777 10.3 Jo	774 8.2 Hf	775 10.8 Pt	754 9.9 Pb	780 9.4 Jo	601 10.6 Bm
777 12.8 Wa	774 8.0 Lr	780 9.9 Es	756 9.8 Pb	780 9.8 Hf	652 12.7 Fc
777 12.7 Wp	774 7.8 Kg	V Vul	756 9.9 Fr	780 10.0 Dl	685 14.0 Bm
780 12.4 Rb	776 6.8 Bj	203226	757 9.8 Fr	781 10.0 Dl	689 13.9 Bm
U Cyg	776 7.0 Pt	775 8.9 Pt	758 9.7 Fr	783 10.0 Dl	781 14.0 Ie
201647	777 7.7 Jo	R Mic	766 10.7 B	783 9.2 Jo	X Cap
740 7.2 Bj	777 7.7 Sx	*203420*	766 11.1 Bs	RZ Cyg	*210221*
743 6.8 Rb	778 8.3 Mc	738 12.9 Bl	775 12.4 Pt	204846	636 10.6 Fc
743 7.4 Lu	780 7.8 Rb	747 12.2 En	U Del	752 12.4 B	720[12.7 Bl
745 7.1 Wh	780 7.9 Kg	Y Del	204017	766 12.5 Wa	747[12.4 En
745 6.8 Ko	781 8.0 Cm	203611	757 7.0 Lt	766 12.7 Wp	RS Aqr
746 7.5 Ah	783 7.6 Jo	752 12.3 Hk	763 6.7 Lt	775 12.2 Pt	*210504*
747 6.8 Pk	U Mic	752 12.1 B	V Aqr	S Ind	635 11.9 Fc
747 8.1 Kp	*202240*		204102	*204954*	636 12.0 Fc
748 7.1 Hh	738[13.0 Bl		749 8.7 Hu	720 13.2 Bl	639 13.2 Fc

Variable Star Observations Received During December, 1934.

J.D.Est.Obs. J.D.Est.Obs. J.D.Est.Obs. J.D.Est.Obs. J.D.Est.Obs.

RS Aqr
210504
772 11.4 B
Z Cap
210516
601 14.7 Bm
635 10.7 Fc
637 10.9 Fc
640 10.9 Fc
649 10.3 Fc
658 10.2 Bm
689 9.2 Bm
703 9.4 Bm
772[13.8 B
R Equ
210812
601 11.1 Bm
636 12.8 Fc
658 13.9 Bm
689[14.0 Bm
717[13.9 Pd
729[13.4 Bm
752 12.3 B
776 12.2 Pt
T Cep
210868
716 10.2 Fc
743 10.0 Lu
743 9.8 Rb
745 9.6 Ah
745 8.8 Ko
746 9.6 Ah
747 9.8 Kp
747 9.5 Pk
749 8.7 Sq
750 9.4 Pk
751 9.5 Ah
751 9.7 Hf
751 9.5 Rb
753 9.8 Si
754 8.8 Jo
754 9.2 Kp
756 8.8 Rb
758 9.6 Lu
760 9.0 Kp
762 9.3 Ra
765 8.7 Pk
767 9.0 Ba
767 8.6 Io
767 9.4 Fs
768 9.3 Sx
769 8.7 Pk
773 8.9 Ah
773 8.3 Hz
774 9.0 Ba
774 9.2 Lr
774 8.7 Kg
774 9.2 Hf
776 8.4 Pt
777 8.8 Wd

T Cep
210868
779 8.8 Bs
780 8.6 Ba
780 9.4 Rb
780 7.9 Jo
781 9.0 Dl
782 8.8 Sx
RR Aqr
210903
635 11.7 Fc
636 11.5 Fc
640 11.3 Fc
773 13.7 B
Y Pav
211570
746 5.6 Ht
755 6.0 Ht
X Peg
211614
635 12.3 Fc
636 12.3 Fc
749 10.2 Hu
771 9.6 Be
772 9.5 Gy
776 9.5 Pt
778 9.6 Wa
T Cap
211615
720 9.5 Bl
738 10.9 Bl
752 11.6 B
761 12.4 B
S Mic
212030
720 8.9 Bl
738 9.0 Bl
738 8.9 dK
745 9.1 dK
747 8.5 En
751 9.4 dK
757 9.5 dK
764 9.7 dK
Y Cap
212814
635[13.1 Fc
724[13.2 Pd
738[13.1 Bl
W Cyg
213244
771 6.4 Kd
778 6.7 Mc
S Cep
213678
724 8.7 Pd
748 9.9 Hh
748 9.6 Hf
749 8.8 Sq
754 8.7 Jo
755 9.7 Je

S Cep
213678
763 8.2 Dt
764 8.2 Dt
767 10.0 Sf
767 10.1 Hh
767 9.8 Je
767 9.6 Ba
767 8.7 Jo
768 8.2 Dt
769 8.2 Dt
772 9.8 Je
774 9.5 Ba
774 8.5 Dt
774 10.0 Hf
775 10.0 Ra
776 8.7 Pt
778 8.5 Dt
779 8.8 Jo
780 9.9 Ba
783 8.7 Jo
RU Cyg
213753
743 8.7 Cl
744 9.1 Ry
748 8.4 Cl
750 9.1 Ry
753 8.8 Bc
753 8.8 Hv
754 8.9 Jo
755 8.9 Je
756 8.8 Bc
756 8.8 Hv
756 9.2 Ry
756 9.1 Cl
756 8.6 Wa
756 8.7 Wp
759 8.9 Wp
759 8.8 Wa
767 8.8 Jo
767 8.7 Je
772 8.9 Je
772 9.2 Ry
774 9.0 Wa
774 9.2 Wp
776 9.3 Wp
776 9.4 Wa
776 8.6 Pt
777 8.9 Jo
783 9.0 Jo
RV Cyg
213937
776 6.5 Pt
RR Peg
214024
635 10.2 Fc
716 12.9 Fc
776[12.6 Pt

R Gru
214247
720 8.5 Bl
738 9.1 Bl
739 9.0 dK
745 9.2 dK
746 9.7 Ht
747 9.9 En
751 9.7 dK
755 10.0 Ht
757 10.0 dK
764 10.8 dK
VV Cep
215363
750 5.4 Lt
757 5.4 Lt
772 5.4 Lt
V Peg
215605
635 10.7 Fc
640 11.0 Fc
654 11.6 Fc
657 11.5 Fc
776[12.7 Pt
U PsA
215628
747[12.2 En
U Aqr
215717
657[13.4 Fc
S PsA
215828
747 11.3 En
TW Peg
215927
757 8.1 Lt
763 8.1 Lt
772 8.3 Lt
RT Peg
215934
766 12.0 B
RZ Peg
220133b
772 9.7 Gy
T Peg
220412
640 12.9 Fc
654 13.1 Fc
766[13.8 Hi
Y Peg
220613
601 14.7 Bm
654 13.8 Fc
657 13.7 Fc
658 13.6 Bm
675 12.1 Bm
703 10.6 Bm
717 10.0 Pd
729 11.0 Bm
772[13.3 Gy

RS Peg
220714
601 14.2 Bm
657[13.7 Fc
675[12.4 Bm
223462
717 12.9 Pd
729 13.2 Bm
772 12.4 Gy
X Aqr
221321
601[13.5 Bm
657 10.5 Fc
658 10.6 Bm
675 9.1 Bm
703 8.7 Bm
729 9.5 Bm
748 10.5 Cl
774 12.2 Wa
774 12.2 Wp
781 12.2 Bj
T Gru
221938
747 8.6 En
S Gru
221948
740 8.4 dK
745 8.3 dK
746 8.2 Ht
747 7.8 En
751 8.2 dK
755 8.4 Ht
757 8.1 dK
764 8.1 dK
RV Peg
222129
654 12.9 Fc
773[13.8 B
S Lac
222439
745 9.1 Ko
749 9.4 Hu
769 8.0 Md
772 8.1 Sx
774 8.0 Hf
775 7.9 Md
778 7.8 Md
780 7.6 Md
780 7.6 Es
782 7.7 Sx
787 7.5 Md
R Ind
222867
720 10.4 Bl
738 9.9 Bl
746 10.0 Ht
749 9.9 En
755 10.2 Ht
W Cep
223257
757 8.5 Lt

W Cep
223257
765 8.6 Lt
T Tuc
223462
739 11.4 dK
745 11.4 dK
746 11.8 Ht
749 11.1 En
751 11.7 dK
755 12.3 Ht
757 11.8 dK
767[11.8 dK
R Lac
223841
751 9.3 Sq
774 11.1 Hf
777 11.8 Bs
782 11.8 Ra
S Aqr
225120
636 12.8 Fc
640 13.3 Fc
657 13.3 Fc
780 7.8 Jo
783 7.9 Jo
RW Peg
225914
601 12.9 Bm
636[13.8 Fc
654[13.8 Fc
675[11.7 Bm
712 12.3 Fc
729 11.1 Bm
748 11.4 Ar
748 11.6 Fr
748 11.2 Wu
753 11.2 Wu
754 11.5 Pb
756 11.7 Pb
756 11.5 Fr
757 11.7 Fr
757 12.4 Bs
766 11.6 Wa
766 11.5 Wp
767 11.7 Sf
770 11.9 Ra
776 11.7 Pt
778 11.6 Wa
781 12.4 Bs
R Peg
230110
636 10.9 Fc
638 10.8 Fc
640 10.8 Fc
654 9.3 Fc
657 9.3 Fc
745 8.9 Ah
746 9.0 Ah
749 9.5 Hu

Variable Star Observations Received During December, 1934.

J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.
R Peg			**S Peg**			**Z And**			**R Aqr**			**R Aqr**			**R Cas**		
230110			231508			232848			*233815*			*233815*			235350		
749	9.0	Sq	640	9.8	Fc	776	10.4	Pt	749	10.3	Hu	780	10.3	Rb	746	7.5	Ah
751	9.4	Hf	654	9.3	Fc	778	10.6	Md	750	9.8	Bc	780	10.6	Jo	747	7.5	Kp
756	9.3	Jo	657	9.3	Fc	779	10.7	Md	750	9.8	Hv	780	10.6	Bj	748	8.0	Hk
766	9.9	Sx	724	7.4	Fc	779	10.6	Es	750	9.9	Pk	780	11.0	Gy	748	7.5	Sq
766	9.5	Dl	744	8.4	Ah	780	10.7	Es	751	10.1	Sq	780	10.5	Kd	751	7.7	Ah
767	9.7	Dl	746	8.6	Ah	**ST And**			751	10.1	Hf	781	11.0	Bs	751	7.9	Hf
767	9.5	Sf	749	8.7	Sq	*233335*			751	10.0	Rb	783	10.5	Jo	752	7.3	Ks
772	10.0	Wd	749	8.7	Hu	749	9.4	Hu	752	9.7	Bc	**Z Cas**			754	7.5	Kp
773	9.6	Ah	751	8.9	Hf	751	9.4	Hf	753	10.0	Bc	233956			754	7.4	Jo
774	9.7	Hf	755	9.0	Je	754	8.8	Jo	753	10.0	Hv	724	14.3	Pd	766	8.2	Sq
774	10.2	Dl	767	9.6	Je	757	9.0	Bs	753	10.1	Jo	766	13.4	Bs	766	8.9	Dl
775	9.9	Ra	772	9.7	Je	774	9.5	Hf	753	10.1	Si	**RR Cas**			768	8.1	Sx
776	10.2	Pt	773	9.6	Ah	776	9.0	Pt	756	10.0	Bc	235053			773	7.9	Ah
776	10.4	My	774	9.6	Hf	776	8.9	My	756	10.0	Hv	748	12.8	Hk	774	8.4	Hf
777	9.9	Hf	776	9.6	Pt	777	9.0	Jo	756	10.3	Jo	777	13.7	Bs	775	8.4	Ra
777	9.8	Sf	777	9.8	Wd	781	9.5	Bs	757	10.0	Bs	**V Cep**			776	8.4	Wd
780	10.4	Dl	780	10.2	B	782	9.2	Ra	759	10.2	Wa	235182			781	9.3	Dl
V Cas			**V Phe**			783	8.9	Jo	759	10.0	Wp	757	6.4	Lt	782	8.9	Sx
230759			*232746*			**R Aqr**			765	10.3	Pk	**R Phe**			783	8.0	Jo
747	11.8	Ks	746	10.8	Ht	*233815*			766	10.0	Rb	*235150*			**Z Peg**		
748	11.5	Hk	749	11.6	En	636	10.7	Fc	767	10.3	Pk	749	13.0	En	235525		
752	11.1	Ks	755	11.6	Ht	638	10.3	Fc	767	10.3	Jo	**V Cet**			637	11.7	Fc
755	11.7	B	**Z And**			640	10.7	Fc	767	10.0	Gy	*235209*			640	11.6	Fc
757	11.4	Bs	232848			657	9.5	Fc	769	10.3	Bj	636	11.7	Fc	654	10.5	Fc
775	10.4	Ra	636	10.8	Fc	715	9.0	Bl	769	10.3	Pk	640	12.0	Fc	749	8.7	Hu
776	10.3	Pt	743	10.7	Ar	720	9.2	Bl	770	10.4	Kd	657	12.7	Fc	754	8.2	Jo
780	10.3	Hf	745	10.6	Ko	724	9.1	Bl	772	10.6	Ra	738	13.0	Bl	767	8.8	Gy
781	10.2	Bs	747	10.7	Ar	737	9.6	Ht	772	10.1	Gy	**R Tuc**			776	8.6	Pt
W Peg			747	10.5	Pk	738	9.4	Bl	772	10.5	Sx	*235265*			**W Cet**		
231425			748	10.7	Ar	740	10.0	Bj	774	10.6	Rb	739	10.9	dK	*235715*		
636	10.4	Fc	750	10.7	Pb	743	9.6	Rb	774	10.3	Wa	745	10.9	dK	656	8.9	Fc
638	10.4	Fc	753	10.7	Ar	744	9.7	Ko	774	10.4	Wp	746	11.0	Ht	777	13.5	Kd
640	10.4	Fc	754	10.8	Io	744	9.6	Rb	776	10.5	Wp	747	11.6	En	**Y Cas**		
654	10.6	Fc	756	10.7	Pb	746	10.0	Rb	776	10.4	Wa	751	11.2	dK	235855		
724	11.6	Fc	757	10.8	Pb	746	9.8	Ht	777	10.3	Wa	755	12.4	Ht	755	12.6	B
748	11.8	Cl	758	10.9	Pb	748	9.8	Bc	777	10.5	Wd	**R Cas**			**SV And**		
754	11.0	Jo	774	10.7	Hf	748	9.8	Hv	777	10.5	Wp	235350			235939		
776	10.4	Sx				748	10.1	Hf	777	10.5	Jo	745	7.6	Ah	654	10.9	Fc
783	10.0	Jo							777	10.3	Hf	745	7.5	Wh	781	12.4	Bj
									780	10.3	Hf						

Rapidly Varying Irregular Variables.

Star	J.D.	Est.	Obs.	J.D.	Est.	Obs.	Star	J.D.	Est.	Obs.	J.D.	Est.	Obs.
005840 RX		**Andromedae—**					060547 SS		**Aurigae—**				
	7744.3	11.7	Ry	7759.7	13.2	Wa		7675.5	11.5	Bm	7768.8	13.2	Hi
	7744.6	11.9	Ko	7766.5	11.2	Ry		7716.5	15.0	Bm	7772.5	12.4	Gy
	7745.3	11.9	Ry	7767.4	11.0	Ry		7727.5	11.0	Bm	7773.5	11.0	Wp
	7745.6	11.8	Ko	7767.5	11.2	Gy		7733.4	11.0	Bm	7773.6	11.0	Wa
	7748.6	12.0	Ar	7772.4	12.8	Ry		7744.3	12.5	Ry	7774.6	11.1	Wp
	7750.3	11.8	Ry	7772.5	12.7	Gy		7745.6	13.0	Hr	7774.6	11.2	Wa
	7750.5	11.8	Wu	7774.6	13.0	Wa		7748.7	15.1	Ar	7775.7	11.3	Pt
	7751.6	11.6	Ko	7774.6	13.0	Wp		7749.4	12.5	Ry	7776.6	12.4	Wa
	7753.3	11.8	Ry	7774.7	13.0	Pt		7753.6	14.8	Ar	7776.6	12.5	Wp
	7753.7	11.6	Ar	7776.6	13.3	Wa		7755.3	12.5	Ry	7776.7	12.1	Pt
	7753.9	11.6	Ko	7776.6	13.2	Wp		7756.6	14.9	Wa	7777.6	12.5	B
	7755.3	12.1	Ry	7777.6	13.5	Wp		7759.6	13.9	Wa	7777.6	13.1	Wa
	7756.5	12.3	Ry	7777.6	13.7	Wa		7766.7	13.9	Wp	7777.6	12.9	Wp
	7759.6	13.3	Wp	7780.5	12.7	Gy		7767.5	14.9	Wa	7777.7	13.2	Pt

VARIABLE STAR OBSERVATIONS RECEIVED DURING DECEMBER, 1934.

Star	J.D.	Est.	Obs.	J.D.	Est.	Obs.	Star	J.D.	Est.	Obs.	J.D.	Est.	Obs.
060547 SS AURIGAE—							180445 NOVA HERCULIS—						
	7779.6	[12.5	Jo	7782.7	[12.5	Ra		7795.6	2.0	Hu	7799.5	2.1	Re
	7780.6	[13.9	B	7783.7	[12.5	Jo		7795.5	2.1	KA	7799.5	2.5	C
	7781.6	[13.9	Ie	7784.7	[12.5	Pt		7795.5	2.1	Re	7799.5	2.3	C
074922 U GEMINORUM—								7796.5	2.3	Cu	7799.5	2.2	Cu
	7716.5	14.1	Bm	7774.6	14.2	Wp		7796.6	2.3	Cu	7799.5	2.1	Aw
	7727.5	14.6	Bm	7775.7	[12.4	Pt		7797.5	2.7	Mt	7799.5	2.4	Rb
	7733.5	[13.7	Bm	7776.6	14.0	Wa		7797.5	2.7	KA	7799.9	2.3	Cu
	7744.7	[12.4	Ko	7776.6	14.0	Wp		7797.5	2.7	Re	7800.5	2.3	Mt
	7748.7	14.2	Ar	7776.7	[12.4	Pt		7798.5	3.0	Pv	7801.5	3.4	C
	7751.7	[13.3	Be	7777.6	14.2	Wp		7798.5	3.4	Mt	7801.5	3.0	Re
	7753.7	14.1	Ar	7777.6	14.2	Wa		7798.5	3.2	C	7802.5	2.5	C
	7753.9	[12.4	Ko	7783.7	[13.3	Pt		7798.5	3.0	Cu	7802.5	2.6	Cu
	7774.6	14.3	Wa	7784.7	[12.4	Pt		7798.5	3.4	Re	7802.5	2.5	Mt
081473 Z CAMELOPARDALIS—								7798.9	2.8	Bi	7802.5	2.5	Re
	7744.3	11.6	Ry	7774.7	10.9	Pt		7798.9	2.1	Rf			
	7744.6	11.6	Ko	7775.7	10.8	Pt	202946 SZ CYGNI—						
	7745.6	11.7	Ko	7776.6	11.0	Wa		7774.7	8.9	Pt	7783.6	8.9	Pt
	7748.6	12.3	Ar	7776.6	11.1	Wp		7775.7	8.9	Pt	7784.7	9.5	Pt
	7750.3	12.2	Ry	7776.7	10.8	Pt		7776.6	8.9	Pt	7785.7	9.7	Pt
	7751.5	11.6	Ko	7777.6	11.2	Wa		7777.6	8.9	Pt			
	7752.8	11.0	Es	7777.6	11.3	Wp	213843 SS CYGNI—						
	7753.3	11.6	Ry	7777.6	10.8	Jo		7652.5	11.8	Fc	7749.5	12.0	Ar
	7753.6	11.5	Ar	7777.6	11.0	Pt		7659.5	11.7	Fc	7749.5	12.1	Hu
	7753.6	11.7	Jo	7778.7	11.5	Md		7670.5	8.6	Fc	7749.6	12.2	Hu
	7753.9	11.5	Ko	7779.8	11.6	Md		7716.3	12.2	Fc	7749.6	12.0	Dh
	7755.3	11.6	Ry	7779.9	11.6	Es		7737.8	9.2	Es	7749.7	12.1	Hk
	7756.6	11.6	Ry	7779.9	11.6	Es		7743.5	10.9	Af	7749.7	12.2	Hu
	7767.5	13.2	Gy	7780.7	11.8	Es		7743.5	11.0	Fr	7750.6	11.6	Bc
	7767.6	[12.0	Jo	7780.7	11.7	Md		7743.7	11.4	Ar	7750.6	12.0	Hv
	7772.5	10.4	Gy	7783.7	12.8	Pt		7743.7	11.2	Rb	7750.6	11.6	Pb
094512 X LEONIS—								7743.8	11.4	Dh	7750.7	12.0	Pk
	7783.9	[12.6	Pt					7744.3	12.0	Ah	7751.5	12.0	Ah
180445 NOVA HERCULIS—								7744.5	12.2	Fr	7751.5	11.9	Ko
	7786.5	3.4	Si	7792.4	1.9	C		7744.6	12.1	Af	7751.6	11.9	Fr
	7786.5	3.4	C	7792.5	1.9	Ha		7744.6	11.6	Ko	7751.6	12.0	Af
	7787.4	3.2	C	7792.5	2.1	Du		7744.6	11.5	Sq	7751.6	12.3	Rb
	7787.5	2.8	Jo	7792.5	1.8	Wb		7744.6	11.5	Hv	7752.6	12.1	Hk
	7787.5	3.2	Si	7792.5	2.1	Lw		7744.7	11.5	Bc	7752.6	12.0	Pk
	7789.5	2.6	Jo	7792.5	2.0	Mt		7744.7	11.8	Ko	7752.6	12.0	Es
	7789.5	2.5	Hu	7792.5	2.0	Vy		7745.0	12.0	Hr	7752.6	12.0	B
	7789.4	2.8	C	7792.5	2.0	KA		7745.3	12.0	Ah	7753.5	11.8	Hv
	7789.5	2.7	Si	7792.5	1.9	C		7745.5	11.7	Ko	7753.6	11.8	Bc
	7789.5	2.8	Sb	7792.5	1.8	Mz		7745.7	11.7	Ko	7753.6	11.9	Pb
	7789.5	2.7	PG	7792.5	1.8	Cu		7746.3	12.0	Ah	7753.6	12.0	Af
	7789.5	2.7	SG	7792.9	1.9	SG		7746.6	[11.3	Rb	7753.6	12.1	Ar
	7789.9	2.8	Cu	7793.5	1.9	Lw		7747.7	12.0	Pk	7754.5	12.1	Wa
	7789.9	2.6	SG	7793.5	1.4	C		7747.7	11.9	Ar	7754.6	12.0	Jo
	7790.4	2.4	C	7793.5	1.5	Mt		7747.7	11.9	Dh	7754.6	12.0	Pb
	7790.5	2.4	KA	7793.5	1.5	Vy		7748.6	12.0	Hf	7755.6	12.0	B
	7790.5	2.3	Cu	7793.5	1.5	Re		7748.6	12.0	Fr	7756.5	11.9	Jo
	7790.5	2.3	Mz	7793.5	1.5	KA		7748.6	11.9	Af	7756.5	12.0	Pb
	7790.5	2.3	C	7793.5	1.5	Wr		7748.6	11.6	Bc	7756.6	11.8	Bc
	7790.5	2.4	Vy	7794.5	1.3	Mt		7748.6	12.0	Lf	7756.6	11.8	Hv
	7790.5	2.5	SG	7794.5	1.3	Vy		7748.7	12.1	Hk	7756.6	12.1	Wa
	7790.5	2.3	Jo	7794.5	1.3	KA		7748.7	11.6	Hv	7756.6	12.0	Fr
	7790.9	2.3	Cu	7794.5	1.3	Re		7748.7	11.8	Ar	7756.6	12.0	Wp
	7791.5	2.3	Lw	7795.4	2.2	Hu		7748.7	11.7	Ar	7756.6	12.4	Rb
	7791.5	2.4	KA	7795.5	2.1	Mt		7748.7	11.9	Dh	7756.6	12.0	Wd
	7791.9	1.9	Cu	7795.5	2.0	Hu		7749.5	12.0	Fr	7756.7	12.0	Cl

VARIABLE STAR OBSERVATIONS RECEIVED DURING DECEMBER, 1934.

Star	J.D.	Est.	Obs.	J.D.	Est.	Obs.	Star	J.D.	Est.	Obs.	J.D.	Est.	Obs.
213843 SS CYGNI							213843 SS CYGNI—						
	7757.5	12.0	Fr	7767.5	11.8	Gy		7774.6	12.2	Rb	7779.8	10.1	Md
	7757.6	12.3	Bs	7767.6	11.9	Sf		7775.6	11.6	Pt	7780.5	9.8	Rb
	7757.7	12.0	Pb	7767.7	12.0	Pk		7775.6	10.8	Si	7780.5	9.7	Hf
	7757.8	11.8	Hu	7768.7	11.9	Pk		7775.7	11.8	Ra	7780.6	9.7	Es
	7757.8	12.2	Ar	7768.7	12.0	Ra		7776.6	11.6	Pt	7780.6	9.5	B
	7758.6	12.1	Pb	7769.7	11.9	Pk		7776.6	11.4	B	7780.6	9.5	Bj
	7758.6	12.3	Dh	7770.5	11.7	Fr		7776.6	11.8	Ra	7781.5	9.3	Sf
	7758.6	12.0	Fr	7770.6	11.7	Ar		7776.6	11.5	Wp	7781.6	9.5	Bs
	7759.5	12.0	Ko	7770.6	11.8	Af		7776.6	11.6	Wa	7781.6	9.3	Sx
	7759.6	12.0	Wa	7770.8	11.6	Ra		7776.6	11.1	Wd	7781.6	9.8	Rb
	7760.5	11.9	Wa	7770.8	11.7	Sx		7777.5	10.9	Wd	7782.6	9.4	Bj
	7760.6	11.9	Wp	7771.3	11.8	Be		7777.5	10.8	Hf	7782.6	9.4	Ra
	7761.6	12.0	B	7772.5	11.9	Gy		7777.5	10.5	Si	7782.6	9.3	Sx
	7762.7	11.9	Ra	7772.7	12.1	Ra		7777.6	11.6	Wa	7782.6	9.1	Si
	7765.7	12.0	Pk	7773.2	11.8	Ah		7777.6	11.1	Wp	7783.5	8.7	Wd
	7766.5	11.8	Bs	7773.6	11.6	B		7777.6	11.0	Sf	7783.6	8.9	Pt
	7766.5	12.2	Rb	7773.6	11.6	Wp		7777.6	10.5	Bs	7783.6	8.4	Sx
	7766.6	11.6	B	7773.6	11.7	Wa		7777.7	11.7	Pt	7783.6	8.7	Si
	7766.6	12.0	Wp	7773.6	11.0	Si		7778.5	10.6	Wa	7784.5	8.5	Si
	7766.6	12.0	Wa	7773.7	11.8	Hz		7778.6	10.4	Sf	7784.6	8.8	Pt
	7766.6	12.0	Wd	7774.5	11.6	Wp		7779.5	10.2	Bs	7785.6	8.8	Pt
	7767.5	11.7	Wa	7774.5	11.6	Wa		7779.8	9.8	Es	7786.6	8.8	Si
	7767.5	11.8	Wp	7774.6	11.6	Pt							

SUMMARY FOR DECEMBER, 1934.

Observer	Initial	Vars.	Observations	Observer	Initial	Vars.	Observations
Ahnert	Ah	33	90	Halbach	Hk	16	18
Andrews	Aw	1	1	Hamilton	Hm	8	38
Armfield, D.	Af	15	47	Hartmann	Hf	78	146
Armfield, L.	Ar	38	109	Harwood	Ha	1	1
Baldwin	Bl	90	172	Hassler	Hz	18	18
Ballhaussen	Ba	11	24	Heines	Hh	3	6
Bappu	Bm	39	135	Hickerson	Hc	1	1
Belsham	Bj	28	35	Hildom, A.	Hi	14	20
Benini	Be	21	21	Hood	Ho	1	1
Bouton	B	51	71	Houghton	Ht	66	106
Bowie	Bi	1	1	Houston	Hu	28	43
Brady	By	3	3	Howes	Hv	24	97
Brown, S. C.	Bs	34	42	Huruhata	Hr	8	23
Buckstaff	Bc	24	91	Iedema	Ie	6	6
Callum	Cl	11	16	Jansen	Je	7	23
Campbell	C	3	15	Jones	Jo	138	370
Christman	Cm	23	41	van de Kamp	KA	1	7
Cunningham	Cu	1	11	Kanda	Kd	13	40
Dalton	Dt	1	6	King	Kg	15	29
Diedrich	Dh	9	27	Kirkpatrick	Kp	11	24
Doolittle	Dl	22	75	de Kock	dK	21	92
Duncan	Du	1	1	Kohman	Ko	54	78
Ensor	En	46	48	Kotsakis	Ks	9	10
Ellis	Es	17	25	Lewis	Lw	1	3
Fish	Fs	5	9	Loepfe	Lf	2	2
Focas	Fc	109	300	Loreta	Lt	26	53
Frister	Fr	19	83	Lucas	Lu	10	39
Friton	Fn	1	1	Luechinger	Lr	6	6
Gaposchkin, C. H. P.	PG	1	1	McKnelly	My	14	14
Gaposchkin, S. I.	SG	1	4	McLeod	Mc	11	20
Gregory	Gy	33	45	Menzel	Mz	1	2
Groeschel	Gl	1	5	Millard	Md	15	23
				Mitchell, S.A.	Mt	1	8
				Peck	Pb	20	58

Observer	Initial	Vars.	Observations	Observer	Initial	Vars.	Observations
Peltier	Pt	161	198	Smith, F. W.	Sf	17	27
Perkinson	Pk	21	47	Smith, L.	Sh	1	1
Plakadis	Pd	33	34	Smith, F. P.	Sq	21	24
Popkavich	Pv	4	9	Swope	Sb	1	1
Preucil	Pf	13	15	Vyssotsky	Vy	1	4
Raphael	Ra	58	68	Wade	Wh	9	9
Recinsky	Rc	5	10	Walton	Wu	9	10
Reuyl	Re	1	8	Watson	Wa	34	103
Rosebrugh	Rb	20	99	Webb	Wd	38	66
de Roy	Ry	8	33	Whipple	Wb	1	1
Salanave	Sx	33	51	Wirtanen	Wr	1	1
Shinkfield	Sl	10	10	Woods	Wp	31	89
Shultz	Sz	11	11				
Simpson	Si	18	42	Totals		92	429	3952

Maximum 276 of SS Cygni, of the C3 type, rose to magnitude 10.0 on December 7, six days before predicted date. The next maximum, 277, is due to attain the tenth magnitude on January 29.

For the first time we include in this report observations received from our Greek contributors, Messrs. Plakidis, Focas, and Kotsakis. We are pleased to include their observations in our records and take this occasion to compliment these observers on their excellent observations.

LEON CAMPBELL, Recorder.

January 15, 1935.

Meteor Notes from the American Meteor Society

By CHARLES P. OLIVIER, President

By this time we have received enough reports from various parts of the world to justify giving some conclusions on the Leonids of 1934. We are particularly fortunate in having good sets of counts on a number of nights from both India and Japan, which greatly facilitate the fixing of the time of maximum frequency. Preliminary inspection of data for the past several years had led us to the conclusion that the chances were that the maximum would fall in daylight for eastern America, in other words somewhere near local noon on the civil date November 16. Such prediction being inherently uncertain, we did not publish it, thinking that it would do more harm than good in discouraging observers.

Table I gives rates as reported to us, complete except for the coöperative groups observing in Colorado, Kentucky-Tennessee, Michigan, Ohio, Pennsylvania-Maryland, and Wisconsin. The high rates, exclusive of those on November 16-17 in North Carolina, are given also in Table II, expressed for uniformity in G.C.T., which is contrary to our usual practice, but useful in bringing data together from such widely different longitudes. (Our tables usually give standard times, expressed with 0^h at noon, according to the old astronomical reckoning.)

TABLE I

Observer and Station	1934 Nov.	Began	Ended	Total	Met.	F.	Rate	Cr.R.
MEMBERS:								
(*1)A. R. Allen, Trinidad, Colo.	15	15:00	17:15	135	23	1.0	10.2	10.2
(*33)R. M. Dole and W. L. Holt, Scarboro, Maine	14	12:20	16:23	203	98	1.0	..	..
(*2)C. B. Ford, Ann Arbor, Mich...	15	13:05	16:05	180	19	1.0	..	..
(*1, 3)N. J. Heines, Paterson, N. J...	15	11:00	14:30	210	18	..	..	..

Observer and Station	1934 Nov.	Began	Ended	Total	Met.	F.	Rate	Cr.R.
(*4) Mary L. Jewett,	11	13:30	15:00	60	3	1.0	..	..
(*4) Grandview, Tenn.	12	12:30	16:00	120	15	1.0	..	..
(*4)	13	12:00	17:00	180	14	0.9	..	..
(*4)	14	14:30	15:00	30	5	1.0	..	..
(*4)	15	13:30	14:30	60	20	1.0	..	..
		15:00	16:30	90	28	1.0	18.7	18.7
	16	11:00	13:30	120	9	0.7	4.5	6.4
		16:00	17:00	60	28	1.0	28.0	28.0
Mohd. A. R. Khan, Begumpet,	9	22:35	23:25	50	4	..	4.8	..
Deccan, N. S. R., India.	10	21:40	22:15	35	3	..	5.1	..
(Reporting in G.C.T.)	11	21:10	21:30	20	0	0.6	..	..
	12	21:00	22:00	60	2	..	2.0	..
	13	20:30	21:30	60	3	..	3.0	..
	14	21:05	22:05	60	6	..	6.0	..
	15	20:40	21:40	60	3	..	3.0	..
	16	22:05	23:05	60	22	..	22.0	..
	17	21:30	22:30	60	12	..	12.0	..
(*1) G. P. Kirkpatrick,	11	13:15	14:15	60	4	0.7	4.0	5.7
(*5) Piermont, N. Y.	14	13:05	16:15	190	34	1.0	10.7	10.7
(*1) J. E. Lamb,	14	16:30	17:30	60	7	0.5	7.0	..
(*1) Regina, Sask., Canada	15	15:55	17:55	120	28	1.0	14.0	14.0
Joseph Leerman,	13	12:55	14:55	120	6	..	3.0	..
Baltimore, Maryland	14	12:55	14:55	120	7	..	3.5	..
	15	13:50	15:10	100	6	..	3.6	..
(*6) F. Preucil, Joliet, Ill.	14	12:45	13:45	60	120	..	..	..
J. H. Pruett, Eugene, Oregon	15	15:00	15:15	15	5	..	..	..
(*19) Rhode Island Amateur Astro-	14	12:30	14:50	140	37	..	..	..
(*19) nomical Society, Providence	16	13:00	17:15	255	81	..	..	..
(*7) W. Riggs, Pelly, Texas	15	14:56	16:03	127	42	0.8	19.8	24.8
(*8)	16	16:45	17:55	70	14	0.8	12.0	15.0
D. E. Williamson, Northfield, Minn.	16?	13:06	14:06	60	14	0.7	14.0	20.0
Catawba College Group, Salisbury, N.C.								
(*9) Harvey Bernhardt	14	12:30	13:30	60	4	..	4.0	..
(*9)	15	13:00	14:30	90	25	..	16.7	..
(*9)	16	14:00	15:00	60	21	..	21.0	..
(*9) Arthur Menius	14	12:30	13:30	60	8	..	8.0	..
(*9)	15	13:00	14:30	90	23	..	15.3	..
(*9)	16	14:00	15:00	60	23	..	23.0	..
(*10) Edgar Barr	14	14:00	14:30	30	11	..	22.0	..
(*13)	15	16:55	17:55	60	25	..	25.0	..
(*12)	16	17:30	18:00	30	13	..	26.0	..
(*11) Prof. M. L. Braun	14	16:45	18:00	75	21	..	16.8	..
	16	6:00	10:00	155	6	..	2.3	..
(*11)		14:15	17:30	180	105	..	35.0	..
(*11) John Braught	15	12:00	12:30	30	4	..	8.0	..
(*11)	16	13:00	14:00	60	11	..	11.0	..
(*14) Carleton Brodbeck	15	13:30	14:30	45	18	..	24.0	..
(*9) Chester Fultz	15	13:30	15:30	105	56	..	32.0	..
(*9)	16	15:30	17:30	120	89	..	44.5	..
(*12) William Wiley	15	13:30	15:30	105	36	..	20.6	..
(*12)	16	15:30	17:30	120	77	..	38.5	..
Ralph Frantz	15	14:05	15:30	85	38	..	26.8	..
(*13)	16	15:00	16:15	75	28	..	22.4	..
(*13) Everett Lynch	15	16:55	17:55	60	36	..	36.0	..
(*13) Russell Hetrick	16	7:00	8:30	90	5	..	3.3	..
(*13)		13:00	14:00	60	26	..	26.0	..
(*13) Allen Deibert	16	8:30	9:30	60	2	..	2.0	..
(*13) Wade Leonard	16	10:50	13:00	130	14	..	6.5	..
(*13) Susan Blackwell	16	12:00	13:00	60	6	..	6.0	..
(*9) Eddie Bowman	16	12:00	13:00	60	0	..	0.0	..
(*13) Bernice Byrd	16	12:00	13:00	60	2	..	2.0	..
(*13) Janette Finger	16	12:00	13:00	60	3	..	3.0	..

Observer and Station	1934 Nov.	Began	Ended	Total	Met.	F.	Rate	Cr.R.
(*13) Rose Lyerly	16	12:00	13:00	60	0	..	0.0	..
(*9) Rachel Smith	16	12:00	13:00	60	2	..	2.0	..
(*13) Paul Wright	16	12:00	13:00	60	2	..	2.0	..
(*13)	17	16:20	17:20	60	17	..	17.0	..
(*13) E. K. Whitener, Jr.	16	14:05	15:15	70	47	..	40.3	..
(*13) Frankie Van Loan	17	16:15	17:30	75	10	..	8.0	..
NON-MEMBERS:								
Lucile Austin, Denver, Colo.	15	14:30	17:00	120	76	1.0	38.0	38.0
(*15) Frank Corti and Gino Corti, San Francisco, Calif.	15	15:30	16:45	75	16	..	..	..
(*15) H. G. Fergus, New York, N. Y.	14	15:00	17:25	145	6	..	2.5	..
(*15) Attilio Ferrari, San Francisco	15	11:30	12:30	60	1	..	..	..
(*15) California		13:00	15:00	120	12	..	6.0	..
(*16) Jonathan Gillingham,	14	13:00	16:00	180	103	..	..	..
(*17) Maryville, Tennessee	15	13:00	15:00	120	184	..	..	..
(*18)	16	13:00	16:00	180	137	..	..	..
(*19)		16:30	17:20	50	53	..	..	..
(*20) N. Iedema, Great Neck, Long Island, New York	16	14:50	16:50	120	6	..	3.0	..
Junior Astronomy Club, Hi-Isle, City Island, L. I. Sound, N. Y.								
(*21) Hubert Bernhard	16	13:15	16:00	165	29	0.9	10.6	11.8
(*22) Robert Fleischer	16	14:00	16:00	120	16	1.0	8.0	8.0
(*23) Ruth Fleischer, Louise Heynick	16	14:00	16:00	120	34	0.9	17.0?	18.9?
(*24) James Rothschild	16	14:00	16:00	120	26	0.9	13.0	14.4
(*25) Kōzirō Komaki,	15	13:30	17:00	200	42	0.6	12.6	21.0
(*26) Kanaya, Aritagun,	16	14:00	17:30	180	66	0.7	22.0	31.4
(*27) Wakayamaken, Japan	17	15:30	17:30	100	37	0.7	22.2	31.7
(*28)	15	13:30	17:00	210	176	0.8	..	..
					135	0.8		
(*29)	16	14:00	17:30	210	546	1.0	..	..
					283	0.7		
(*30)	17	15:40	17:40	120	187	1.0	..	..
					146	1.0		
Harry J. Leasen, Woodside, Calif.	13	15:10	16:06	56	5	..	5.4	..
(*15) San Francisco, Calif.	15	14:43	15:41	58	8	..	8.3	..
(*15) John Markel, Ernest Tordsen, Carl Sitzensfatter, Susalito, Calif.	15	12:52	17:05	253	16	1.0	..	..
(*3) J. G. McIlvain, Jr., Overbrook, Pennsylvania	16?	11:15	12:00	45	5	0.3?	6.7	..
(*31) Ralph P. Monell, Colorado Springs, Colorado	15	14:45	15:30	45	15	..	20.0	..
		13:30	14:45	75	10	..	8.0	..
		14:15	14:45	30	9	..	18.0	..
(*32) Cecil Olmstead, Walter Gregroff, Angwin, Calif.	15	15:15	17:45	150	207	0.9	..	..
Katherine Rasmussen, Muskegon, Michigan	16	13:00	14:00	60	2	..	2.0	..
(*34) Susuma Sasabé, Takaha,	11	13:00	17:30	270	61	0.9	13.6	15.1
(*35) Kobé, Japan	15	13:50	15:20	120	46	0.8	23.0	28.8
(*36)	16	14:15	17:30	195	120	0.9	35.9	39.9
(*37)	17	15:15	17:40	145	74	0.9	30.6	34.0
(*15) R. E. Shupe, H. E. Hulick, San Francisco, Calif.	15	15:30	16:06	36	14	..	..	..

REMARKS.

(1) Plotted. (2) Plotted while serving as time-keeper for other observers. (3) Bright moonlight. (4) From window, N and E. (5) 14 plotted. (6) 16 observers; highest solo count, 19. (7) 28 plotted. (8) 10 plotted. (9) Facing NE. (10) Facing SE. (11) Facing E. (12) Facing S. (13) Facing N. (14) Facing NW. (15) Diagrams or notes on each. (16) 7 observers. (17) 9 observers. (18) 15 observers. (19) 3 observers. (20) 4 plotted. (21) Gerald Farr, recorder; notes on each. (22) Alfred Elk, recorder; notes on each. (23)

Both observers also listed as recorders; number assumed to be that seen by single observer; notes on each. (24) Dorothy A. Bennett, recorder; notes on each. (25) 1 Leonid plotted. (26) 24 plotted; 44 Leonids observed. (27) 15 plotted; 14 Leonids observed. (28) Counts by 2 groups of 9, 2 of the observers in each group recording. (29) Counts by 2 groups of 8, 2 of the observers in each group recording. (30) Counts by 2 groups of 7, 2 of the observers in each group recording. (31) Reports by 3 students. (32) Paths plotted; 187 with no duplicates; maximum rate after 17:15, when 87 were seen in 30 minutes. (33) 35 plotted. (34) 23 Leonids; assistant observer and recorder for all four nights, Mrs. Moriko Sasabé. (35) 20 Leonids. (36) 80 Leonids. (37) 46 Leonids.

TABLE II

Observer and Station	1934 Nov.	Began	Ended	Total	Met.	F.	Uncor. Rate
Mary L. Jewett, Grandview, Tenn. ..	16	9:00	10:30	90	28	1.0	18.7
Lucile Austin, Denver, Colo.	16	9:30	12:00	120	76	1.0	38.0
C. Olmstead, W. Gregroff, Angwin, California	16	11:15	13:45	150	207	0.9	*
K. Komaki, Kanaya, Japan							
Group of 8, 2 recording	16	17:00	20:30	210	546	1.0	..
Group of 8, 2 recording	16	17:00	20:30	210	283	0.7	..
S. Sasabé, Kobé, Japan	16	17:15	20:30	195	120	0.9	35.9
M. A. R. Khan, Begumpet, India ...	16	22:05	23:05	60	22	..	22.0

*87 in last 30 minutes, no duplicates counted.

Table II seems to indicate fairly well that the maximum began near 13^h, culminated about 19^h, and had fairly well passed by 22^h. The rate for other California observers was far lower than the one given above, but in general they observed a little earlier, and the high rate was just before dawn. However, we find an unexpected secondary maximum most distinctly shown for the next night from reports of observers in Maryland, North Carolina, and Tennessee. As the observations in Table I show, for November 17, 8^h to 11^h G.C.T. approximately, the Salisbury, N. C., rate was 40 or more per hour, based on a number of independent counts. Rates at least two-thirds as high were simultaneously obtained at Sykesville, Maryland, and Grandview, Tennessee. As the rate was far lower at Philadelphia and farther north (so far as we now know), it would seem that a small difference in latitude had considerable effect upon the numbers visible. The rate at Salisbury fell off sharply for the period just before dawn, showing that this secondary group was of restricted extent.

Unfortunately we have no reports as yet from either Hawaii or ships at sea between those islands and Japan. Thus we find, despite the enormous increase in interest in meteors, that for far the larger per cent of the earth's surface we still lack observers, on both land and sea.

From reports at hand it seems most doubtful if the individual observer's rate for all meteors rose to sixty per hour at any time. Also we have the definite statement from the observers at Kanaya, Japan, that out of a total of 829 meteors counted by 12 observers, only 587 were Leonids. Professor Komaki states in his letter that Leonids appeared at the rate of 2 or 3 per minute about 4^h J.S.T. (19^h G.C.T.), and about 10 brighter than 0^M were observed hourly. This was presumably for his whole group. He says further that the display was richer than that he saw in 1932 or 1933. Even at this, it seems very doubtful if it was anything like as good as the 1901 display in America.

We can only repeat the opinion published in an earlier issue, which is that we have lost touch with the main or denser part of the Leonid stream, and it will be practically impossible to make predictions for their return in the 1966± epoch.

Five of our regional groups have sent in duplicate observations of the Leonids.

From these we hope in due time to compute and publish heights. With the increasing volume of A.M.S. work and no increase in staff at the Flower Observatory, long delays are inevitable. We can only assure our collaborators that reductions of their valuable work are made as rapidly as circumstances permit.

Flower Observatory of the University of Pennsylvania,
Upper Darby, Pennsylvania, 1935 January 17.

The Annual Deposit of Meteoric Material*

By C. C. WYLIE

In earlier papers we have discussed the probable numbers for naked-eye meteors, telescopic meteors, and meteorites. We have also discussed the probable masses of meteors of various magnitudes. For the number of naked-eye meteors, our result was about 24,000,000 per day. Using the more recent group counts made under our direction, the figure is not changed appreciably. This in turn agrees well with Newton's result published about 1884, that the daily number of naked-eye meteors "is not less than 20,000,000." For the telescopic meteors the first good data on the relative numbers of meteors of various magnitudes have been furnished by the observations of the Harvard-Cornell station in Arizona.

We, ourselves, have done no further work on the annual number of meteorites since publishing the paper previously referred to. The late Dr. Fisher of Harvard, however, made a computation using our method of attack and obtained practically the result which we had published. We believe that his result has not been published, but it was communicated to us by letter. This is a distinctly higher figure for the annual number of meteorites than the earlier estimates which were, however, not based on calculation. Our figures for the masses of meteors of various magnitudes are slightly larger, but of the same order of magnitude, as the figures arrived at by Öpik, Sparrow, and Maris.

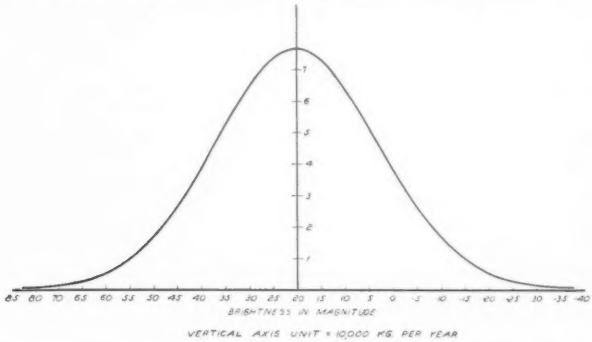
Multiplying the individual mass by the number for each of the various magnitudes, it appears that, as far as we have useful data, the meteoric material in space is distributed approximately according to the probability curve. For the abscissa, x, we used the magnitude at the height of the ordinary shooting star. For the ordinate, y, we used the total amount of material reaching the earth each year. From the data at hand, it appears that the maximum for this curve occurs in the telescopic meteors, and for fainter meteors than those for which we as yet have useful data. The maximum is, therefore, as yet uncertain, but we have constructed a curve which fits the data at hand satisfactorily. The equation is:

$$y = 71.8e^{-.00171\,(20-x)^2}$$

The curve indicates that the total number of telescopic meteors must be millions of millions per day. For meteors which, just before bursting, light up the landscape brighter than the full moon, the annual number falling within a circle of radius of 280 miles is about 200. For detonating meteors the annual number falling in a circle of the same size is about 10. Most of these detonating meteors would presumably drop some meteorites. This number of detonating meteors appears to be of the right order, since in the calendar year 1934 we have, at Iowa City, interviewed observers on four meteors which produced detonations in the communities near the point of fall.

*Presented at the Philadelphia meeting of the American Astronomical Society, December, 1934.

Integrating the area under the curve we obtain, on the assumption that the curve is correct, the total amount of meteoric material reaching the earth each year. This includes everything from the smallest telescopic to the large crater-producing objects. Using half of the curve, which would presumably give too small a figure, the result is 1.56×10^6 kilograms per year. Using the full curve, and assuming it symmetrical, the result is 3.12×10^6 kilograms per year. This figure is probably too large as radiation pressure would affect the extremely small particles. Let us adopt 2×10^6 kilograms per year as the rate.



Using the adopted figure we find that the annual fall of meteoric material on each square mile would be ten grams. If this material all comes down eventually as dust or larger particles, the radius of the earth would be increased by one inch in about 2×10^{10}, or twenty billion, years. In Russell-Dugan-Stewart's "Astronomy" we find that the age of the earth is estimated as four or five billion years, so at the present rate of fall of meteoric material, the radius of the earth would be increased by only a fraction of an inch in the estimated life time of the earth.

This work has been supported in part by a grant from the Smith fund of the National Academy of Sciences.

University of Iowa, December 28, 1934.

Contributions from the Society for Research on Meteorites

Edited by FREDERICK C. LEONARD, President, *and* H. H. NININGER, Secretary

The Surface Features of Meteorites*

By H. H. NININGER

According to Farrington, the forms of meteorites depend chiefly on the amount of shaping which they undergo in their passage through the atmosphere. He believed that the amount of atmospheric shaping was independent of the size of the meteorites and largely independent of the substance of which meteorites are composed. In his opinion, the degree of shaping was dependent largely upon velocity, the lower velocity giving more time for shaping.[1]

*A paper delivered at the Second Annual Meeting of the Society, held at the University of California, Berkeley, on June 18 and 20, 1934.

[1] *Meteorites*, O. C. Farrington, 1915, p. 60.

The purpose of this paper is to consider these and certain other principles in the light of recent observations, with a view to ascertaining what are their implications, and, if possible, to discover the true significance of certain characteristic surface features of meteorites; for it is really apparent that their surface features are of first importance in our understanding of what takes place between the time when a meteorite encounters the outer atmosphere and its subsequent landing in the soil. When once we have attained an adequate understanding of this period in the history of meteorites, we shall have gone a long way toward solving the problems which relate to the importance of meteorites in the process of earth-building. In our consideration of this problem, it seems best to divide the discussion into two parts and to deal with the two main types of meteoritic material separately.

We shall first consider aërolites or stony meteorites. In this group the majority of individuals are of irregular form with edges and corners rounded, the general surface more or less pitted, and completely covered by a fusion crust. Frequently, an individual is met with in which there is a tendency toward symmetry, and specimens are not wanting in which the form approaches that of a perfect cone or a dome. Such specimens are rare, however, and must be considered the exception rather than the rule. Where found, these conoidal specimens almost always show more or less furrowing and an arrangement of thread lines which give unmistakable evidence of an oriented flight during at least part of the journey through the atmosphere. In such specimens Farrington pointed out that the pits are more or less oval in outline with the broad end farthest from the apex or nose of the meteorite.

If one carefully examines the surface of any stony meteorite which has not undergone sufficient weathering to obliterate the more delicate of its flight markings, it is possible to discover on many parts of its crust indications of the angle of incidence of air impingement. This, in the case of the conoidal stone, is found to have been from the general direction of its apex. From this point, one can trace the course of the dominant air currents radially, with occasional deflections of greater or less magnitude, which are due to irregularities of its surface. When the periphery is reached, we see where some of the molten liquid has been driven over the edge of the stone and has congealed on the protected rear surface. Here, sometimes, the slaggy crust acquires several millimeters of thickness, while on the sloping sides this crust is very thin. It is logical to assume that the great bulk of molten material has been swept outward on all sides of the flying missile; for the blast of air against the face of the moving stone far surpasses in violence that accompanying the discharge from the muzzle of a gun. The accummulations on the rear side of the stone must constitute only a very insignificant trifle as compared with what was driven off by the terrible air blast from the fore.

The writer has been greatly impressed recently by the finding of evidence of the great rapidity with which the shaping of meteorites may take place. The falls of March 24, 1933, and August 8, 1933, were both forenoon falls and both were meteorites of high velocity. The former, which lent itself to fairly accurate measurements, had an average velocity of about twenty miles per second during its visible course, and the latter, while it was not possible to measure its speed with certainty, seems to have had a velocity but slightly less. Both of these falls produced unusually large aërial displays. In each the detonations were audible from distances of nearly a hundred miles. Both were visible over very large territories and both gave evidence, during flight, of more than the usual amount of disintegration. Upon examination, both meteorites were found to be composed of very friable material, and in both cases only small individual stones have been

found, although there has been carried on more than the usual program of search. Each of the fragments found so far has been completely encrusted, and in about fifty per cent of the cases, these have shown almost perfect orientation. Also, they have, in all cases, been found along the line of flight several miles back of the spot where the projected line of flight should have landed them. In the case of the March 24 fall, finds were made as far as ninety miles short of the end point of the projected path, or 35 miles back of where the light disappeared. Here, apparently, we have evidence that the stones found were merely detached fragments which were thrown off from a larger mass and that they were completely encrusted after leaving the main mass. The fact that there was a series of flashes or "explosions" witnessed by many persons prior to the extinguishment of the fireball, would be in harmony with such an explanation; and since one of these explosions was registered photographically it can scarcely be doubted. The writer believes that here we have examples of meteoritic fragments which were completely encrusted, and, in several cases, symmetrically shaped, in the brief period—probably less than one second—between the time when the fragment was detached from the parent body and the time when it ceased to burn as a "spark" from the fireball. In the case of the March 24 fall, the maximum distance of burning flight of a particle was about three miles. If it is possible for a fragment to be shaped into a symmetrical four-ounce stone within less than a second, in the latter part of a meteor's course, when its velocity is approaching the lower limit for luminescence, then we may be sure that the amount of disintegration in the upper atmosphere which accompanies ordinary visible meteors is very considerable.

We have said that the majority of aërolites do not show evidence of orientation, but are in most cases irregular in form. Indeed, a careful study of them gives the impression that they have resulted from the disruption of a mass into angular blocks which have had their angles subdued by surface fusion.

More than forty per cent of the stony meteorite falls discovered have consisted of more than one individual. Since these figures are based entirely upon the finds made, we may assume that the percentage is much higher than this, for surely there is small chance that a fall will be recovered in its entirety. Indeed, with every added year of experience on the part of the writer in collecting meteorites, he becomes more doubtful that a stony meteorite ever penetrates the entire atmospheric blanket and arrives at the soil as a single individual. It seems evident that we must choose between the view that most stony meteorites are disrupted in flight and the alternate hypothesis that the members of a fall have existed as a swarm in space.

In considering these two views, Farrington has summed up the arguments in favor of the aërial disruption of meteorites as follows[2]:

1. The angularity of most of the individuals of stone showers.
2. The uniform composition of the individuals of a shower.
3. The appearance of meteors in the air as a ball rather than as a swarm of bodies.
4. The narrow distribution of the components of a shower.

To these should certainly be added the following:

5. The frequent reports by witnesses of the apparent bursting or "exploding" of fireballs.
6. Photographic records of what appear to have been explosive actions in connection with meteors.

[2] *Meteorites*, p. 52.

7. The various degrees of encrustation clearly evident in members of a common fall and in different parts of the same individual.
8. The oft-recorded "booming" or detonation of meteors.
9. The acutal witnessing of black objects scattering from the point where a meteor appears to have exploded.
10. The fitting together of members of the same fall, as in the case of the Butsura and Shelburne stones.

As favoring the view that the members of a shower enter the atmosphere as a swarm, Farrington lists the following facts:

1. The complete encrusting of most individuals of a shower.
2. The small number of showers.
3. The regular form of the area over which a shower distributes itself, and the regular distribution of the individuals within it.
4. The difficulty of breaking up iron masses by atmospheric shock.

Of these arguments, the second and the third have, by recent discoveries, been proved largely invalid. In several instances where falls had been reported as consisting of a single stone, or of a very few stones, the writer has been able to prove that the falls in question were really showers. Doubtless many other similar instances would be discovered if a like investigation were made in connection with each fall. As to the regular distribution of the members of a shower, at least three of the few cases investigated by the writer have failed to show any such symmetrical distribution. As for the fourth argument regarding the difficulty of breaking up iron masses, we simply must face such facts as the Navajo iron, half rent asunder, the two huge complementary masses of the Chupaderos iron, and the thousands of pallasite fragments found in the Haviland crater. There remains only argument one unchallenged, namely, that most of the members of a shower are completely encrusted.

The writer believes that a careful study of a large number of meteoritic surfaces, together with a consideration of the conditions under which this fusion has taken place, gives ample evidence that the rate of fusion on the surface of a meteorite is sufficiently rapid to account for the complete encrusting of fragments within less than a second's time. In support of this belief he submits the following facts:

1. Leaving the question of the exact temperatures of the surfaces of meteorites during flight as unsettled, we may be sure from a study of fallen meteorites that the surface temperature is, in many cases, sufficient to render the exposed material thoroughly mobile.

2. Regardless of whether this temperature is due entirely to friction or to a combination of factors, we may be certain that the molten film at the surfaces of a meteorite is produced in connection with, and is subjected to, the impingement of an air blast that in violence far surpasses anything of its kind which man has as yet been able to produce.

3. With a film of molten liquid forming constantly under an impinging air blast of such violence, the molten stone or metal will of necessity be driven off instantly just as fast as it is formed; thus is provided a unique set-up for surface erosion.

4. That such a set-up actually exists is proved by the stream-lined fusion crust underlaid by stone wholly unaffected by heat; or by iron, the structure of which evidences the fact that temperatures as high as even 800° C. have been restricted usually to depths of one or two millimeters below the fusion crust.

In the light of these facts we may picture the conditions of a falling stone as

it penetrates into the less rarefied atmosphere about as follows: An intensely cold mass whose surface is being reduced to liquid much as when an icicle is held in the flame of a welding torch, except in that the intense heat accompanying the fall is due, at least in large part, to the terrific force of the air blast instead of to the chemical mixture which produces the torch. The stone is moving in a large envelope of super-heated air of which that portion directly in front is constantly being subjected to greater and greater compression. As this pressure becomes effective, either continuously or intermittently, in crushing the stone; or, as superficial heating occasions fracturing, fragments are separated from the parent mass, and follow divergent courses. In these smaller bodies velocity is lost more rapidly than in the main mass. They probably do not retain sufficient velocity to produce superficial liquefaction for more than a few thousand meters; but even this is sufficient, under these unusual conditions, to flame off all of the sharp angles and completely to sear over the lately jagged surfaces. This brief flaming period is what presents to observers the phenomenon of "scattering sparks." Indeed, probably only the most highly heated fragments can be seen as "sparks" by observers, the majority of whom are more than fifty miles from the flaming object and to almost none of whom the fireball approaches as near as twenty miles—a long distance from which to view even our great modern searchlights of artificial production.

The conditions attending the fall of an iron meteorite should not be essentially different from those just described, except in that fracturing would be less frequent, but not at all impossible, when we consider the highly crystalline condition of most iron meteorites and the fact that, except for a very thin surface layer, the mass is severely cold and brittle. It is probable also that in the case of slowly moving iron meteorites, they may, if falling at very low angles (as in the case of the February 12, 1934, fall) have a sufficiently long flight to allow the temperature to mount to where a condition of redness is maintained without the phenomenon of spark production.

We believe, then, that Farrington was correct in his statement that the shaping of meteorites is largely independent of the materials of which they are composed, if in this case we interpret the word *meteorite* to mean an individual stone or iron of a fall, regardless of whether the mass constituted an entire fall or is only a fragment of a larger disrupted body. We believe that this is the meaning intended by Farrington. We accept also his statement that the amount of shaping is independent of the size of meteorites, except as the ratio of the surface, to the mass, of a body increases as its size is reduced.

As to the amount of shaping varying inversely as the velocity: it seems to the writer to be only partially true. Since the rate of removal of molten material varies as the velocity, and since this same velocity governs the intensity of the surface temperature, the logical assumption is that the rate of shaping should vary according to the velocity and the consequent temperature. This assumption has been borne out by a comparison of average weights of forenoon and afternoon falls in which the writer found that the average weight for afternoon falls —that is, low-velocity falls—is more than double the average weight for forenoon falls. Also, so far as is known to him, the percentage of well oriented individuals runs higher in forenoon falls than in those of the afternoon.

Probably the most significant lesson which we may learn from these studies of the surface features of meteorites is to be found in their relation to the question regarding the size of the meteorites which occasion the small meteors of ordinary nightly occurrence. The speculations and calculations which have been regarded

as classic on this point have all been made apparently on the basis of determining the *minimum amount of material* which, when volatilized, would be necessary to produce a given candle power at certain temperatures. This, in the opinion of the writer, is not the important point at all. The question upon which must rest our conclusion as to the sizes of the bodies producing ordinary meteors is one of *duration*. How *large* must a body be in order to survive the period of visibility or length of luminescent path observed in ordinary meteors? We have found in the study of fallen fragments, convincing evidence that a layer at least several millimeters in thickness has been removed over the entire surface of a stone, while it burned through only about a mile of atmosphere at a velocity approaching the lower limit for luminescence. If this be true, then what is the minimum thickness of material which can survive the process of superficial disintegration which takes place while a meteorite is traversing a course of fifteen miles—the average length of visibility for ordinary meteors? As a matter of fact, we should allow for an added distance, both before and after the observed course, to cover the less luminous portions both at the beginning and at the finish, where luminosity is not sufficient to be detected at a distance of a hundred miles—the probable average distance at which ordinary meteors are observed.

The writer is not at all impressed by the statements of those who show by mathematical calculations that a ball of steel one millimeter in diameter is capable of producing an amount of light which fulfills a postulated requirement on the basis of candle power or heat units. He is interested, rather, in the conditions which enable a missile to survive the terrific rate of superficial disintegration which he finds so emphatically registered on the surfaces of the several thousand meteoritic specimens which he has examined.

Siderite Falls in India

By H. H. NININGER

Mohd. A. R. Khan, A.R.C.S., B.Sc., Principal, Osmania University College, Hyderabad, Deccan, India, in his presidential address delivered at the meeting of the Hyderabad Science Association, calls attention to the fall of an iron meteorite on July 23, 1934, at 9:30 P.M., in the Moradabad District.

The published report of this address includes a beautiful photograph of the 23-pound fragment of this iron, which photograph indicates that the specimen is very strongly pitted, and moreover evidences a disruption of the parent mass in its flight through the atmosphere. The specimen seems to show right-angle cleavage, and is compared by Dr. Khan to "a piece of 1½-inch plate iron that has been torn and well battered by shrapnel on both faces."

Because of the extreme rarity of the records of siderites seen to fall, it seems worth while to mention this report as that of the fourth such fall recorded for India.

Secretary's Office: The Nininger Laboratory, 1955 Fairfax Street, Denver, Colorado.

Editorial Office: The Department of Astronomy of the University of California at Los Angeles.

A Fireball Seen in New York City and Vicinity

On the evening of July 23, 1934, a brilliant fireball appeared over Rhode Island, Connecticut, New York, and New Jersey. Since it was the first meteor of any magnitude seen in New York City and the metropolitan area for a long time (other parts of the country being favored apparently in the matter of

meteors), it caused considerable comment. A number of reports concerning it were received by Dr. Clyde Fisher, Curator of Astronomy at the American Museum of Natural History, who suggested that a brief review of these, and of others kindly passed along by the Department of Geology, by the New York *Sun*, and by Dr. Charles P. Olivier, might be of some interest.

As generally described, the fireball appeared in the southern heavens moving almost parallel to the horizon, from east to west. In a period of about 4 seconds it passed over perhaps 25 degrees of sky, leaving behind it a "trail of fire," and exploding near the end of its course. The color was variously given as "dazzling white," "bright yellowish," and "greenish yellow"; and as the light faded it became "red." Interesting to note is the very common comparison made by observers to "a giant airplane in flames."

No fragments of the meteor have been recovered. After a cursory examination of the above-mentioned reports, however, Dr. Olivier believes that some sort of solution for heights, at least, will be possible. Most of these reports were received from observers on or near the coast. No doubt other observers have reported to other institutions: it seems certain that in such a populated district there must have been many other witnesses.

The fireball had the greatest apparent brightness (judging from comparative descriptions) at Madison, New Jersey. From there, while dim to begin with, it steadily increased in brilliance until it rivalled those intensely white magnesium-flares, such as are used in war time. Another report, this one from Bay Head, New Jersey, is unique in describing a "dark object, black in color," which was plainly visible and from which issued "sparks." Some observers (as for example at Ridgefield, Connecticut) saw the final explosion merely as a separation of the meteor into two parts; one, in Brooklyn, New York, saw it break up into "five or six pieces"; while from Garrison, New York, it "burst seemingly into hundreds of fragments." Not a few observers made confident attempts to estimate the meteor's distance: the results ranged, however, from "1000 feet" to "50 or 100 miles."

It might be mentioned that an instance of the value which is derived from popularizing the field of meteoritics and making the general public *meteor-conscious* is given by certain of the reports on this fireball. These came, curiously, from people who only a day or two previous had read an article by H. H. Nininger, appearing in a popular magazine, on the subject of meteors and how to observe them.

ARTHUR DRAPER.

Department of Astronomy, American Museum of Natural History.

Comet Notes

By G. VAN BIESBROECK

Through the usual telegraphic channels, observatories were notified January 9 of the discovery of a new comet by Johnson at Johannesburg (South Africa). The following information was given:

Comet Johnson 1935 Jan. 8.7696 U.T.
Right Ascension $0^h\ 59^m\ 49^s$ Declination $-51°\ 3'$.
Magnitude 10. Daily motion 16^s east and $63'$ north.
Object diffuse. No tail mentioned.

It is somewhat surprising that no results of computation on the orbit have been communicated after two weeks. In fact there has not been any confirmation of the discovery. Visibility was necessarily confined to the southern hemisphere

during the first days. If the northerly motion indicated has been maintained the object should at present be in reach of observers on this side of the equator.

No other comets are known at this time that could be reached with medium-sized instruments. The three periodic comets mentioned last month: REINMUTH 1928 I, SCHWASSMANN-WACHMANN 1925 II, and 1929 I are all faint and require powerful telescopes.

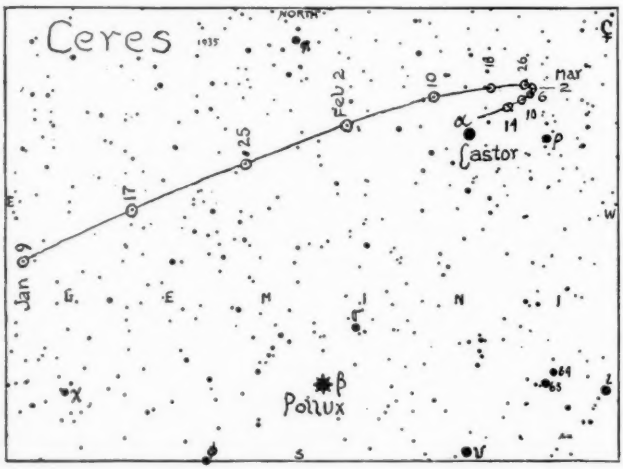
Williams Bay, Wisconsin, January 21, 1935.

Asteroid Notes

By HUGH S. RICE

The year 1934 ended with 1301 asteroids which are sufficiently well known at the *Astronomisches Rechen-Institut* that their elements have been derived and ephemerides computed. Of these 1301, about 110 have not yet received permanent names.

The most easily observable asteroid at the present time is 1 Ceres, the largest of the whole collection of minor planets, and whose diameter has been measured as 480 miles. While the sight of these miniature worlds is anything but spectacular, yet many astronomers never see them at all, either through the telescope visually or by photographing them on a plate. There are hundreds of them with



diameters of 10 to 50 miles only; certain ones under observation when near perihelion probably are but a mile in diameter. If Ceres has a density similar to the earth's crust, it is thought that the total mass would not be over 1/8000 that of the earth. The "velocity of escape" is so small that gases would long ago have been lost from its surface, so that there is no possibility of an atmosphere.

We are exhibiting in this issue a chart showing Ceres' course among the stars in Gemini, so that it can easily be followed. In January it was moving nearly NW; opposition occurred on the 18th. The magnitude, 7.1, is somewhat brighter than its average opposition magnitude (7.4); it decreases to 7.6 in the middle

of March. Beginning with February 1, it can be seen for several weeks with Castor in the same binocular field. This period should therefore be the best possible time to pick up the object with low-power optical aid. It will be much brighter than Neptune, because, while Ceres is far smaller than Neptune, it is much nearer the earth, its distance at opposition this year being 150,000,000 miles. The diagram is based on ephemerides of the *British Astronomical Association*, and the positions are for 6:00 P.M., C.S.T.

We are able to guarantee tolerably well the accuracy of our drawing of minor planet 1—that colossal figure among the asteroids—from past experience with similar plottings, and from the following circumstance: with a similar chart (from the November issue) in hand, and later with the engraver's proof of the present one, the writer has stationed himself at his window in Spuyten Duyvil, New York, with Carl Zeiss *Delfort* binoculars, and has made numerous observations already of Ceres within the last month, with the result that the asteroid has been seen to be closely following its prescribed path. On December 30, observation was delayed until such time as Cancer had attained too high an altitude to be reached by means of indoor observation (which of itself is, particularly in winter, commonly of a perilous nature), so that the expedient was tried of going onto the excellent roof, with its ideal telescopist's (or binocularist's) outlook, and the result was twofold: (a) enhanced seeing, and (b) a change in temperature from 28°.62 to —8° C.

In this case Pollux has been the key star, or the object to locate first in the glass, but in February and March Castor will be sighted first. The apparent distance between Castor and Ceres on February 18 will be 8/10 degree of arc. Asteroid hunting reveals the development of ever-varying triangles. In February and March there will be an ever-varying triangle formed by Castor, ρ Geminorum, and Ceres: from a straight angle on February 2 it makes a triangle which becomes in turn obtuse-angled, right-angled, scalene, isosceles, scalene, isosceles, and scalene. Ceres will form the dimmest of the triangle's vertices, affording about the brightness of the star located on the chart ¼ inch from Castor toward the SE corner.

Planet 2 Pallas is in eastern Aries in February, and of magnitude 8. This asteroid does not have any opposition this year. It could be seen now, although it is getting fainter, but there is no ephemeris available after January, with which to follow its movements. The writer of this "department" has just received an astounding but most encouraging letter indeed from an indefatigable observer (Mr. Morgan Sanders) in Baltimore, who has been following Pallas with a 2¼-inch glass from our charted position of September 16 to a position at the Eridanus-Fornax line on January 17. He made *67 observations* during that period, and we think this a remarkable record. Planet 3 Juno will be observable next autumn and winter in Pisces and Cetus. 4 Vesta is moving eastward from Sagittarius into Capricornus, but the sun is also nearby, so that we shall have to wait until early summer before observing this object again. There will, however, be asteroids available for observation every month. Three of the brighter ones (all of 10th magnitude) are 32 Pomona, retrograding as always when in opposition, back of Hydra's head; 63 Ausonia, a little west of Regulus; 387 Aquitania, about in the middle of Leo; but the only practical way to observe them is to plot their apparent paths through the star fields by means of the ephemerides.

For use with medium-sized telescopes we are giving ephemerides of 2 asteroids selected from the lists of the *Astronomisches Rechen-Institut;* these objects will be convenient for observing at this time. 78 Diana will be in Leo going westward, just south of ρ Leonis. On plotting the position on any other star atlas

than one with the equinox of 1925, first allow +3ˢ2 per year in R.A., and —18″ in Decl.; that is, add these corrections algebraically for precession in going forward in years, or subtract if going backward. On an atlas whose coördinates represent the equinox of 1900, the positions of planet 78 for February 7 would be R.A. $10^h\,42^m2 - [(1925\text{-}1900)\ (+3^s2)] = 10^h\,40^m9$ and Decl. $+9°\ 45' - [(1925\text{-}1900)\ (-18'')] = 9°\ 52'5$.

On March 17, at about 21ʰ G.C.T., Diana will be in conjunction with the moon, and will pass ½° north of it. Planet 212 Medea is also in Leo, in the southern part, and traveling into Sextans. Precession allowances are the same as for Diana. It appears upon very close study of the time-tables of these diminutive worlds that there is a minor planet called 829 Academia, of magnitude 13.5, which will be in conjunction with Neptune on March 11, at 1ʰ G.C.T., and 829 is to pass 44′ north of Neptune.

EPHEMERIDES OF ASTEROIDS FOR 0ʰ G.C.T. EQUINOX 1925.

	78 Diana 9ᴹ.9			212 Medea 12ᴹ.3		
		α	δ		α	δ
		h m	° ′		h m	° ′
Feb.	7	10 42.2	+9 45	7	11 0.3	+3 59
	15	10 34.8	+9 41	15	10 54.9	+4 21
	23	10 26.6	+9 38	23	10 48.9	+4 48
Mar.	3	10 18.4	+9 36	3	10 42.6	+5 17
	11	10 11.0	+9 31	11	10 36.4	+5 47
	19	10 5.1	+9 22	19	10 30.7	+6 15

American Museum of Natural History, New York, January 19, 1935.

Notes from Amateurs

Amateur Telescope Makers of Chicago

The Amateur Telescope Makers of Chicago held their monthly meeting on Sunday, January 13, at 2:00 P.M. in the Adler Planetarium and Astronomical Museum.

Profesor Arthur Howe Carpenter, president of the club, gave an inspiring address on the work of the various groups of amateurs both in instrument making and in observing. He also told of the activities of the British amateurs and cited them as an example which we might well follow.

Dr. Philip Fox, director of the Planetarium, described the exhibits of amateurs at the meeting of the American Association for the Advancement of Science, held in Pittsburgh in the last week in December. He also discussed briefly the subject of meteors from outside the solar system.

1319 W. 78th Street, Chicago, Illinois. WM. CALLUM, Secretary.

Nova Herculis Discovered by American Amateur Astronomer

The following letter, sent to Professor S. A. Mitchell, director of the Leander McCormick Observatory of the University of Virginia, and read at the recent meetings of the American Astronomical Society in Philadelphia, shows that the recent nova in Hercules was discovered independently by Robert A. Lewis, seventeen years of age, and a senior in the High School at Columbia, South Carolina. The letter is dated at 1314 Richland Street, Columbia, S. C., December 20, 1934.

Dear Sir:

I am an amateur astronomer having constructed my own reflecting telescope of six inch diameter and am greatly interested in astronomy. Last night at about

seven o'clock, while returning home from delivering my papers, as is my habit, I "took a look around the sky" and happened to notice a star in the constellation of Hercules that in the past I had never seen in my observations.

It seems to be of about the same magnitude as gamma Draconis or about the second magnitude. It is roughly half way between alpha Lyrae or Vega and gamma Draconis and is very conspicuous to one familiar with the heavens. In Norton's Star Atlas there are no stars at this particular position brighter than the 5.5 magnitude, and as I know no variable star in that place that "takes that big a jump," I sort of suspected that it might be a "Nova."

If I had a spectroscope and a larger telescope I would like to study it out, but I am reporting it to you and hope that you will investigate it and let me know what it is. Above all, don't dub this poor amateur an "ignoramus" if it turns out to be merely an ordinary variable.

Astronomically yours,
(Signed) ROBERT LEWIS.

Zodiacal Light Notes

By FRANKLIN W. SMITH

The morning Zodiacal Light was observed from 5:30 to 5:45 on January 12. The light cone was traced westward to a point a few degrees north of Spica. Its northern edge passed between η and ζ Ophiuchi and through a point three or four degrees south of β Librae; its southern edge passed through ω Scorpii and slightly south of α Librae. It will be noticed that these boundaries place the inner portion of the light cone north of the ecliptic. This shift in position is probably caused by the strong atmospheric absorption of light from the southern edge of the cone which is to be expected as the angle between the horizon and the ecliptic at the time of observation becomes smaller at this season of the year. The evening Zodiacal Light, which is again coming into a favorable position for observation from northern stations, was seen on January 2. It could be traced eastward to a point a few degrees south of λ Aquarii.

The Gegenschein will soon be out of the region of the Milky Way and should be looked for by northern observers while it is still well north of the celestial equator.

407 Scott Avenue, Glenolden, Pennsylvania, January 17, 1935.

General Notes

Dr. Harlow Shapley, Director of the Harvard Observatory and Paine Professor of Astronomy, Harvard University, delivered a series of six illustrated lectures at Northwestern University on the Norman Wait Harris Foundation on January 9, 10, 11, 14, 15, 16. Under the general subject of "Exploring the Galaxies," Dr. Shapley gave specific titles to his lectures as follows: The Seven-Zoned Census, Methods and Machinery, The Confusing Milky Way, The Clouds of Magellan, Galaxies—Types and Activities, The Metagalaxy.

Reverend T. H. E. C. Espin, vicar of Tow Law, England, for forty-six years and an active amateur astronomer throughout this period, died early in December of last year. He discovered numerous double stars and some novae. In recognition of his astronomical work he was made a Fellow of the Royal Astronomical Society. He travelled widely and had collected many geological, botanical, and aquarian specimens.

The Rittenhouse Astronomical Society of Philadelphia held its monthly meeting on Friday, January 11, in the Hall of The Franklin Institute. The program consisted of a lecture entitled "A Modern Budget of Paradoxes." This was the presidential address by Professor W. H. Barton, Jr., Director of the Hyatt Observatory, Pennsylvania Military College.

Southern Stars.—This is the name of a new publication recently inaugurated as the journal of the New Zealand Astronomical Society. No. 1 for November, 1934, and No. 2 for December, 1934, have been received at this office. It is edited by Mr. I. L. Thomsen. Each of these numbers contains sixteen pages and includes a number of short, interesting, pertinent papers. This society is to be congratulated for this new evidence of its activity and enthusiasm.

Summary of Sun-Spot Observations at Mount Holyoke College, 1934

Month	No. of Obs.	North of Equator No. of Groups	North of Equator Av. Lat.	South of Equator No. of Groups	South of Equator Av. Lat.	Av. No. at one Obs.	New Groups
January	22	2	+18°9	0		0.23	2
February	20	2	20.2	2	—23°0	0.70	3
March	24	0		2	13.5	0.12	2
April	24	1	27	1	28	0.62	2
May	27	4	17.8	3	27.9	1.33	7
June	25	2	5.0	1	28	0.72	3
July	17	2	14.0	1	33	1.24	3
September	7	1	22.5	0		0.28	1
October	21	2	13.5	1	22	0.52	3
November	21	1	23	3	25.0	0.57	3
December	19	2	21.9	6	24.8	0.95	8
Totals	227	19		20			37

Average number at one observation 0.68
Average latitude of spots north of equator +16°1
Average latitude of spots south of equator —24.6
No spots were seen on 112 days of observation.
No record was kept from July 31 to September 20.

Most of the observations were made by Miss Marjory Wright; those during the summer vacation were made by Miss Farnsworth.

Seventy-three per cent of these spots were more than 20° from the sun's equator, showing that the new cycle of disturbance is well under way.

ANNE S. YOUNG.

John Payson Williston Observatory.

Correction.—In the January (1935) issue of this publication, lines one and two, for *June 14* and *November 22* please read *July 14* and *November 2*.